



2019 FUSION HYBRID RESPONDER SEDAN MODIFIERS GUIDE



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INTRODUCTION

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Introduction

Introduction

Ford Motor Company has assembled this guide to assist vehicle modifiers in producing a safe and quality vehicle. Ford believes safety and quality come first. To achieve customer satisfaction, we want to assist modifiers in achieving the highest standards of safety and quality in their vehicles.

This book is divided into topics pertinent to vehicle modifiers. References are made to the current Fusion Hybrid/MKZ Hybrid/Fusion Energi Workshop Manual for appropriate service procedures, torque specifications, component separation clearances and other standard information which is common with an unmodified vehicle. Specifications unique to this guide are designated.

This modifier guide is not a "how-to" book; it should be used as a checklist to help make sure that certain important steps in the modification process are considered. It is ultimately the responsibility of the upfitter with knowledge of the entire upfit to ensure the checklist is complete. While Ford is providing this information to assist modifiers, it does not warrant the vehicles, methods, materials or the workmanship of the modifier. Ford also does not warrant against failures that result from the modification of a vehicle.

Following the guidelines contained in this guide does not assure individual modifiers that the products they modify comply with US Federal or Canadian Motor Vehicle Safety Standards in effect at the time of the modification. The guidelines set forth are based on engineering analysis of typical vehicles. If the guidelines are followed, the modifier's efforts in certifying vehicles to applicable standards should be aided. Compliance testing that may be required for certification of specific vehicle configurations or construction is the sole responsibility of the individual modifier.

Genuine Ford Accessories For Your Vehicle

A wide selection of genuine Ford accessories are available for your vehicle through your local authorized Ford or Ford of Canada dealer. These quality accessories have been specifically engineered to fulfill your automotive needs; they are custom designed to complement the style and aerodynamic appearance of your vehicle. In addition, each accessory is made from high-quality materials that meet or exceed Ford's rigorous engineering and safety specifications. Ford Motor Company will repair or replace any properly installed genuine Ford accessory found to be defective in factory-supplied materials or workmanship during the warranty period, as well as any component damaged by the defective accessory. The accessory will be warranted for whichever provides you the greatest benefit:

- 12 months or 20,000 km (12,000 mi), whichever occurs first; or
- the remainder of your new vehicle limited warranty.

This means that genuine Ford accessories purchased along with your new vehicle and installed by the dealer are covered for the full length of your new vehicle's limited warranty — 3 years or 60,000 km (36,000 mi), whichever occurs first. Contact your dealer for details and a copy of the warranty.

Considerations When Using or Installing Accessories

For maximum vehicle performance, keep the following information in mind when adding accessories or equipment to your vehicle:

- When adding accessories, equipment, passengers and/or luggage to your vehicle, do not exceed the gross vehicle weight rating (GVWR) or gross axle weight rating (GAWR) as indicated on the Safety Compliance Certification Label. Consult your dealer for specific weight information.
- The Federal Communications Commission (FCC) and Canadian Radio Telecommunications Commission (CRTC) regulates the use of mobile communication systems, such as 2-way radios, telephones and theft alarms that are equipped with radio transmitters. Any such equipment installed in your vehicle should comply with FCC or CRTC regulations and should only be installed by a qualified service technician.
- Mobile communication systems may harm the operation of your vehicle, particularly if they are not properly designed for automotive use.
- To avoid interference with other vehicle functions, such as the anti-lock brake system (ABS), amateur radio users who install radios and antennas onto their vehicle should not locate the antenna in the area of the driver's side hood.
- Electrical or electronic accessories or components that are added to the vehicle by the dealer or the owner may adversely affect battery performance and durability.

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Section 1: General Information

Section 1: General Information

Important Safety Notice

NOTE:

The descriptions and specifications contained in this guide were in effect at the time this guide was approved for printing. Ford Motor Company reserves the right to discontinue models at any time, or change specifications or design without notice and without incurring obligation.

Appropriate repair methods and procedures are essential for the safe, reliable operation of all motor vehicles as well as the personal safety of the individual doing the work. This guide provides general direction and guidelines for performing modifications to the Fusion/MKZ/Energi vehicle, which will help assure reliability.

There are numerous variations in procedures, techniques, tools and parts for modifying vehicles, as well as in the skill level of the individual doing the work. This guide cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this guide must first establish that they compromise neither their personal safety nor the vehicle integrity by the choice of methods, tools or parts.

Warnings, Notices and Notes

As you read through this guide, you will come across WARNINGS, NOTICES and NOTES. Each one is there for a specific purpose. WARNINGS remind you to be especially careful in those areas where carelessness can cause you personal injury. NOTICES are given to prevent you from making an error that could damage the vehicle or the vehicle's components. NOTES give you added information that will help you to complete a particular procedure. The following list contains some generalized warnings that you should follow when working on a vehicle.

**WARNING:**

- The nominal High-Voltage Traction Battery (HVTB) voltage is approximately 300 volts DC. The HVTB and charging system contain high-voltage components and wiring. High-voltage cables and wiring are orange in color. Before carrying out any vehicle modifications, the HVTB must be depowered. Any modification, service, or repairs to the high-voltage system or its components, must be done by a trained service technician. Failure to follow these instructions may result in severe personal injury or death.
- For eye protection, always wear safety glasses.
- Use safety stands whenever a procedure requires you to be under the vehicle.
- Make sure that the ignition switch is always in the OFF position, unless otherwise required by the procedure.
- Set the parking brake when working on the vehicle. The gear selector should be set in PARK unless instructed otherwise for a specific operation. Place wood blocks (4 inch x 4 inch or larger) against the front and rear surfaces of the tires to help prevent the vehicle from moving.
- Do not smoke while working on a vehicle.
- To reduce the risk of injury, always remove rings, watches, loose hanging jewelry and loose clothing before working on a vehicle.
- When it is necessary to work under the hood, keep hands and other objects clear of the cooling fan blades.
- Failure to follow these instructions may result in personal injury or death.

NOTICE:

- Do not modify the cooling system. High-voltage vehicle components may be damaged if any cooling system modifications are attempted.
- Before placing the vehicle in a paint booth, make sure that the HVTB is not installed in the vehicle. In addition, the Charge Port Light Ring (CPLR) must be covered / protected from heat. High paint booth temperatures may damage the HVTB and the CPLR.
- Remove the service disconnects while carrying out any vehicle modifications.

Making Safety Devices and Elements Inoperative

The vehicle contains many safety features required by US Federal or Canadian Motor Vehicle Safety Standards. These features, which include the key-on-ignition chime and brake lights, should never be disabled or modified.

CFR 49 Section 30122 states that "A manufacturer, distributor, dealer or motor vehicle repair business may not knowingly make inoperative any part of a device or element of design installed on or in a motor vehicle or motor vehicle's equipment in compliance with an applicable motor vehicle safety standard prescribed under this chapter unless the manufacturer, distributor, dealer or repair business reasonably believes

Section 1: General Information

the vehicle or equipment will not be used (except for testing or a similar purpose during maintenance or repair) when the device or element is inoperative."

Good Practices

Process and Quality Assurance Systems

A formalized Process and Quality Assurance Systems check may be helpful in consistently producing high-quality products. An overview of some of the key items for such a system are outlined in this section.

Quality Assurance

Completed unit sign-off: All control items should be inspected with a written sign-off. All labels should be inspected and signed off, including verification that the information on the labels is correct. All appropriate systems should be checked for leaks. A road test should be performed to verify that all systems are operating correctly. All systems and functions that were provided by Ford should be checked to make sure that they function correctly after the build process.

The modifier's Process and Quality Assurance Systems should also make sure that appropriate training is provided to the employees.

Minimum and Maximum Screw Sizes

When installing aftermarket equipment, avoid using fasteners that are too long for the application or are in an area which might damage vehicle components, including the low-voltage wiring, the high-voltage system including the HVTB and the (orange) high-voltage wiring/cables, brake lines, fuel tank and lines, powertrain components, exhaust system or suspension.

Tires and Loading

Tire Replacement Requirements



WARNING:

Only use replacement tires and wheels that are the same size and type (such as P-metric versus LT-metric or all-season versus all-terrain) as those originally provided by Ford. Use of any tire or wheel not recommended by Ford can affect the safety and performance of your vehicle, which could result in an increased risk of the loss of vehicle control, vehicle rollover, personal injury or death. Additionally, the use of non-recommended tires and wheels could cause steering or suspension failure. If you have questions regarding tire replacement, see an authorized Ford or Lincoln dealer.

NOTICE:

Do not install an off road, aggressive tread or incorrectly sized tire. Any of these may cause elevated stress to the steering system. This can cause the power steering system to overheat and shut off the power assist, which can affect the safety and performance of your vehicle.

NOTE:

Fusion/MKZ/Energi vehicles are equipped with a reduced rolling resistance tire design. The use of a different tire can affect the travel distance of the vehicle as well as the vehicle's fuel economy.

Make sure all tires and wheels on the vehicle are of the same size, type, tread design, brand, load-carrying capacity and speed rating because it can affect the safety and performance of your vehicle, which could result in an increased risk of loss of vehicle control.

Using Snow Tires and Traction Devices

NOTE:

Snow tires must be the same size and grade as originally equipped on your vehicle.

The tires on your vehicle have all-weather tread to provide traction in the rain and snow; however, in some climates, using snow tires or traction devices may be necessary.

Follow these guidelines when using snow tires and traction devices:

- SAE Class "S" cables should ONLY be used on the vehicle front tires.
- Install cables or chains securely, verifying that the cables or chains do not touch any wiring or brake lines.
- Drive cautiously! If you hear the cables or chains rub or bang against the vehicle, stop and retighten them. If this does not work, remove the cables or chains to prevent vehicle damage.
- Avoid overloading your vehicle.
- Remove the cables or chains when they are no longer needed; do not use cables or chains on dry roads.

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- Do not exceed 48 km/h (30 mph) with tire cables or chains on your vehicle.

Consult your dealer for information on other Ford approved methods of traction control.

Vehicle Loading



WARNING:

The appropriate loading capacity of your vehicle can be limited either by volume capacity (how much space is available) or by payload capacity (how much weight the vehicle should carry). Once you have reached the maximum payload of your vehicle, do not add more cargo, even if there is space available. Overloading or improperly loading your vehicle can contribute to the loss of vehicle control and vehicle rollover.



WARNING:

Exceeding the Safety Compliance Certification Label axle and/or vehicle weight rating limits could result in substandard vehicle handling or performance, engine, transmission and/or structural damage, serious damage to the vehicle, loss of control and personal injury.

Gross vehicle weight rating (GVWR) is the maximum allowable weight of the fully loaded vehicle (including all options, equipment, passengers and cargo). The GVWR is shown on the Safety Compliance Certification Label located on the B-pillar or the edge of the driver's door.

Gross axle weight rating (GAWR) is the maximum allowable weight that can be carried by a single axle (front or rear). These numbers are shown on the Safety Compliance Certification Label located on the B-pillar or the edge of the driver's door. The total load on each axle must never exceed its GAWR.



WARNING:

Do not use replacement tires with lower load carrying capacities than the original tires because they may lower the vehicle's gross vehicle weight rating (GVWR) and gross axle weight rating (GAWR) limitations. Replacement tires with a higher limit than the originals do not increase the GVWR and GAWR limitations.

Steps for determining the correct load limit:

- Locate the statement "The combined weight of occupants and cargo should never exceed XXX kg or XXX lb" on your vehicle's placard.
- Determine the combined weight of the driver and passengers that will be riding in your vehicle.
- Subtract the combined weight of the driver and passengers from XXX kg or XXX lb.
- The resulting figure equals the available amount of cargo and luggage load capacity. For example, if the "XXX" amount equals 1,400 lb and there will be five 150 lb passengers in your vehicle, the amount of available cargo and luggage load capacity is 650 lb (1400 - 750 (5 x 150) = 650 lb). In metric units (635 - 340 (5 x 68) = 295 kg).
- Determine the combined weight of luggage and cargo being loaded on the vehicle. That weight may not safely exceed the available cargo and luggage load capacity calculated in the step above.

Vehicle Storage

Vehicle Storage — General

- Vehicles should be stored in a dry, ventilated place and protected from sunlight, if possible.
- If vehicles are stored outside, maintenance against rust and damage, as described below, is recommended.

NOTICE:

Keep all rubber parts free from oil and solvents.

Vehicle Storage — Electrical

NOTICE:

If your vehicle is to be stored for 30 days or longer, the low-voltage (underhood) battery negative terminal must be disconnected. Failure to do this could damage the vehicle's battery.

NOTE:

Section 1: General Information

Extended storage time which results in the discharge of the low and/or high-voltage batteries, may result in the setting of DTCs and/or a no-start condition.

In order to maintain the high-voltage battery charge, once a month your vehicle's high-voltage batteries should be charged. This will maintain the high-voltage battery, but may not be enough to maintain the low-voltage (underhood) battery and additional low-voltage (underhood) battery charging may be required after 60 days.

Vehicle Storage — Body

- Wash the vehicle thoroughly to remove any contaminants from the exterior surfaces and underside.
- Periodically wash vehicles stored in exposed locations.
- Touch up any exposed raw or primed metal to provide rust protection.
- Cover chrome and stainless steel parts with a thick coat of auto wax to prevent discoloration. Rewax as necessary when the vehicle is washed.
- Lubricate the hood hinges, door hinges and latches with a light-grade oil.
- Cover the interior soft trim to prevent fading.

Vehicle Storage — Tires

Most high-performance tires are made with nylon overlay.

As such, the following steps should be taken to avoid flat spots on the tires when the vehicle is not used for a period of time.

- Keep the vehicles tire pressure at the recommended operating pressure.
- If the vehicle is stored for a period longer than 15 days, it should be moved several feet during each 15-day period. The vehicle should be parked after being moved so that a different portion of the tread contacts the ground.

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Section 2: High Voltage Battery Depowering

Section 2: High Voltage Battery Depowering

High and Low-Voltage Systems

NOTICE:

Do not backprobe or splice into the high-voltage system. Voltage in the system is approximately 300v DC. Damage may occur to equipment added to the system.

High-Voltage Traction Battery (HVTB)

NOTICE:

Do not backprobe, splice or repair the high-voltage (orange) wiring. Voltage in the system is approximately 300 volts DC. Damage may occur to equipment added to the system.

NOTICE:

None of the BECM wiring should be tapped or spliced to check for battery voltage (power), ground or signals.

The high-voltage traction battery (HVTB) is a 300 volt DC source connected in a floating ground system. The battery receives, stores and delivers high-voltage electrical power when required by the vehicle control strategy. On the HVTB there is 1 controller and a battery energy control module (BECM). There is also the bussed electrical center (BEC) which houses the contacts, current sensor and the associated components. The service disconnect is next to the BEC and is used to disconnect the high-voltage from the vehicle system. Always remove the service disconnects prior to servicing the vehicle.

High-Voltage Traction Battery (HVTB) Systems Depowering

1. Position the vehicle in the repair bay.
2. Turn the ignition switch to the OFF position.
3. Position the appropriate rear seat backrest down.

NOTE:

If the center safety belt retractor locks and the safety belt webbing prevents the 60 percent backrest from lowering, raise the backrest upward to release the safety belt retractor and the belt webbing.

FHEV (HYBRID) BATTERY.

1. Remove the retainer to allow handle operation.

Section 2: High Voltage Battery Depowering

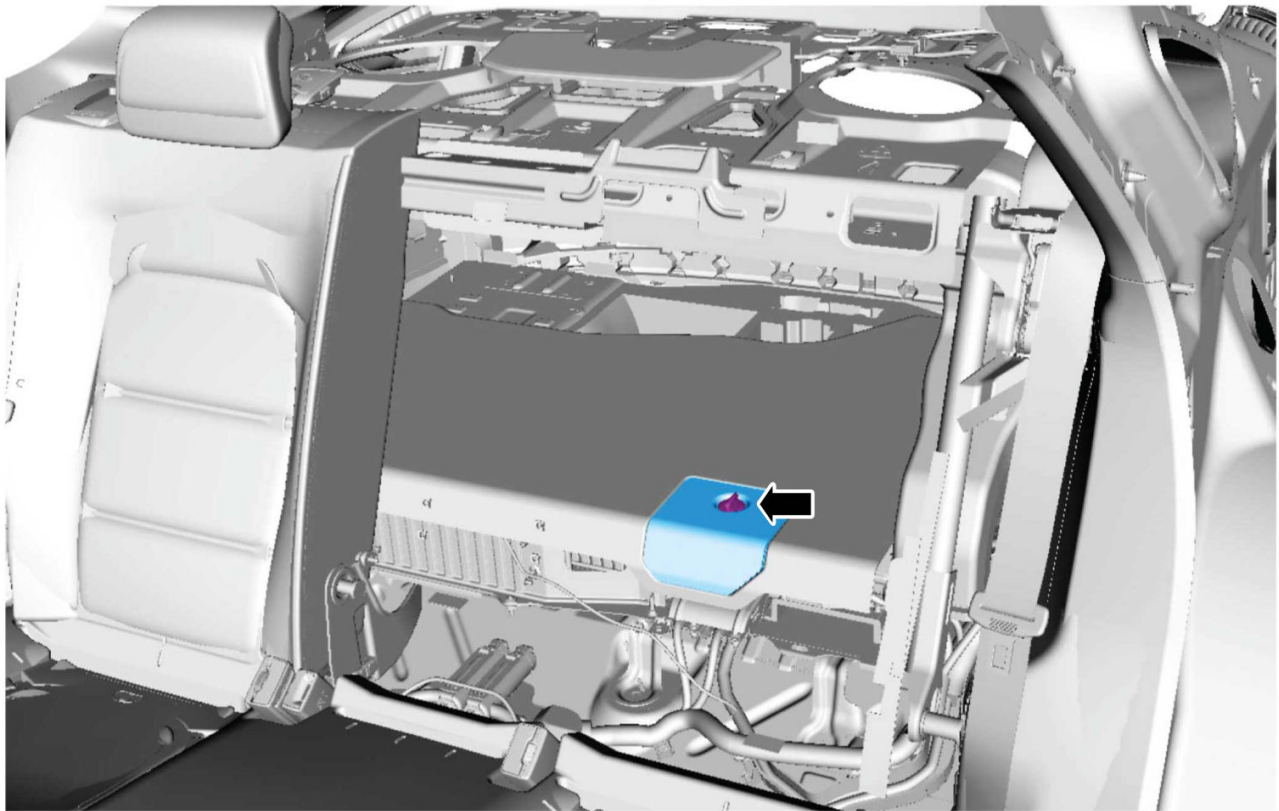


2. Release the handle and pull the seat back forward.



3. Remove the high-voltage battery service disconnect cover.

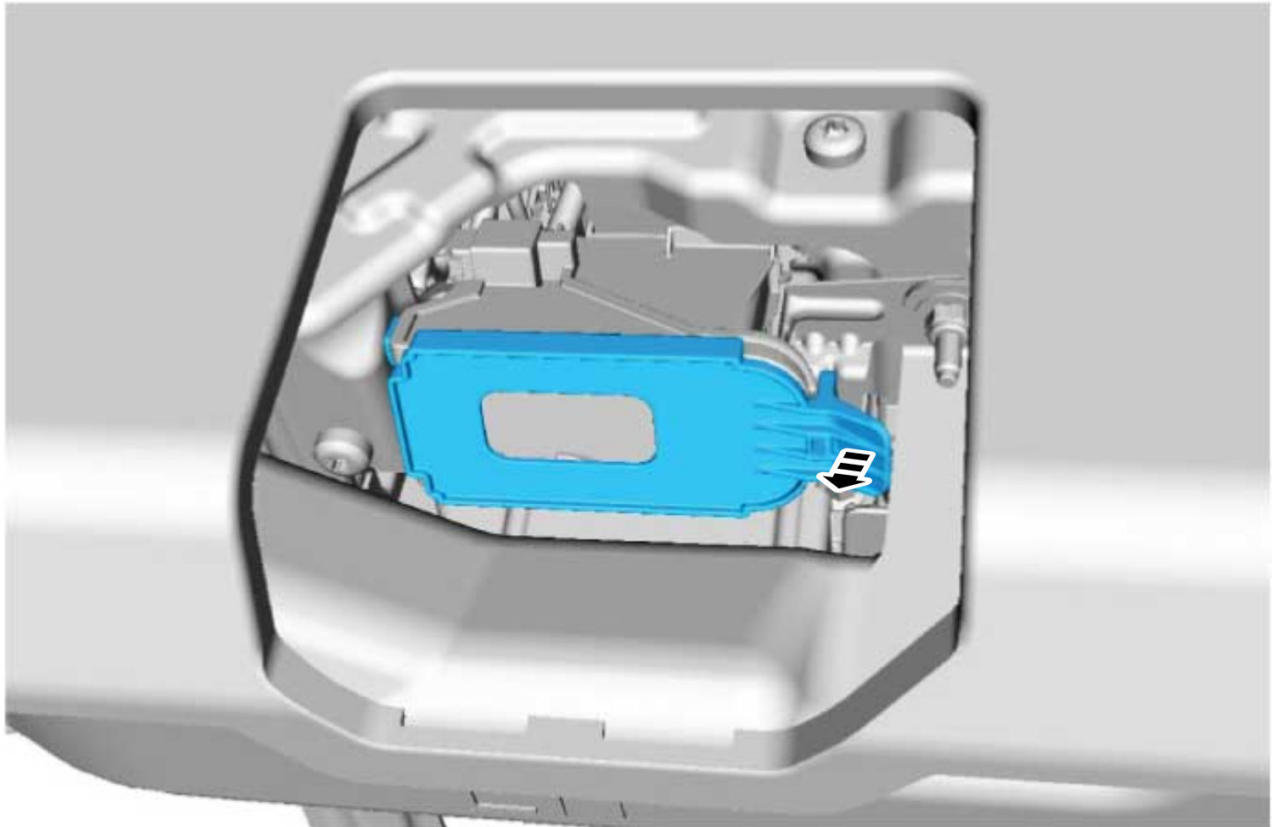
Section 2: High Voltage Battery Depowering



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4. Pull to remove the high-voltage battery service disconnect interlock cover.

Section 2: High Voltage Battery Depowering

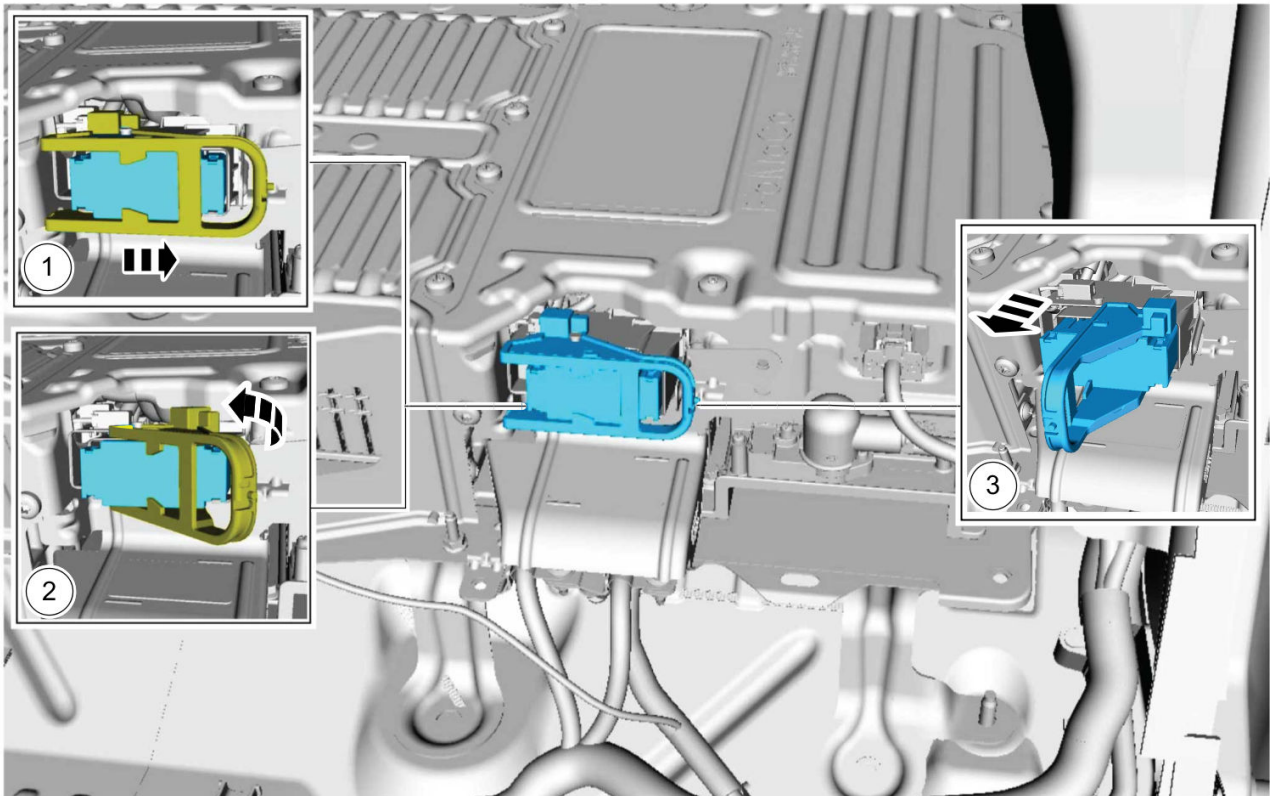


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5. Remove the high-voltage service disconnect:

Pull the Lever Position Assurance (LPA) tab toward the front of the vehicle to remove.
Pull the lever handle outward to disengage the interlock.
Rotate the lever to horizontal and remove the battery high-voltage service disconnect.

Section 2: High Voltage Battery Depowering



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PHEV (ENERGI) BATTERY.

1. Remove the retainer to allow handle operation.

Section 2: High Voltage Battery Depowering

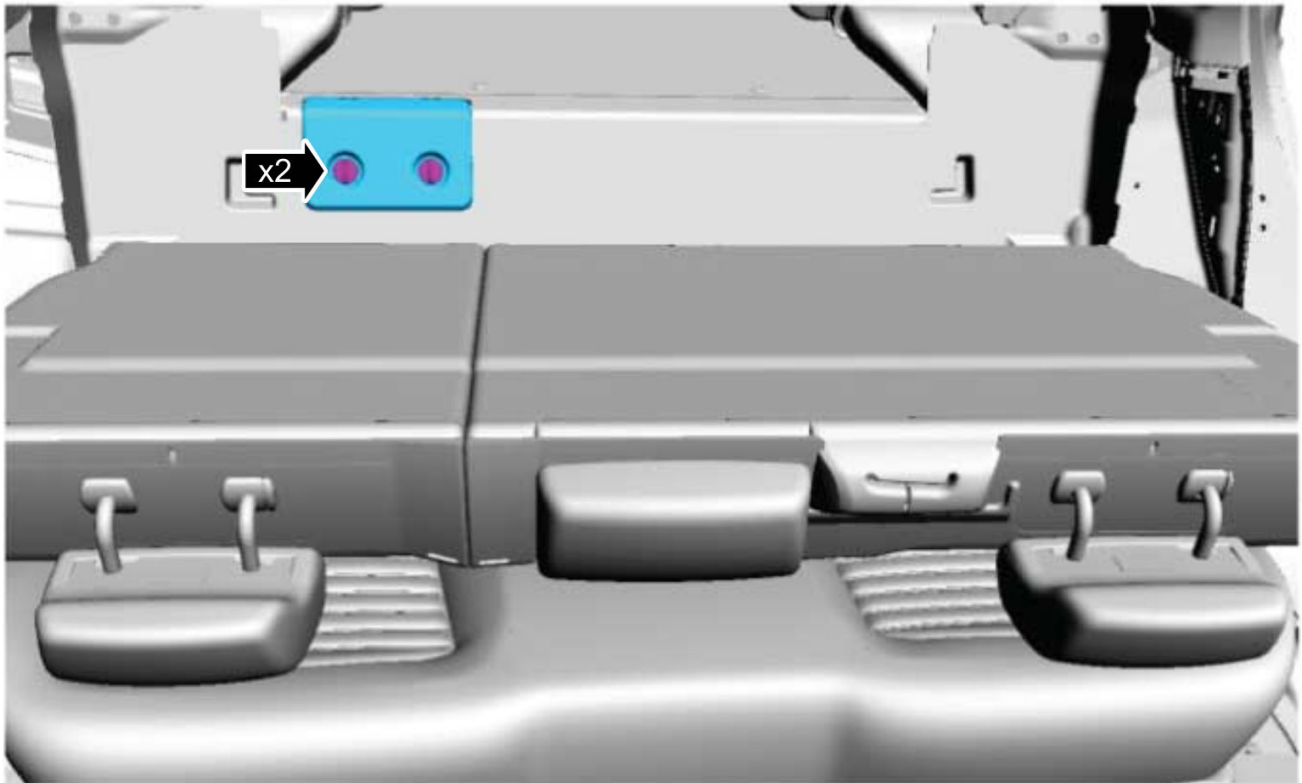


2. Release the handle and pull the seat back forward.



3. Remove the high-voltage battery service disconnect cover.

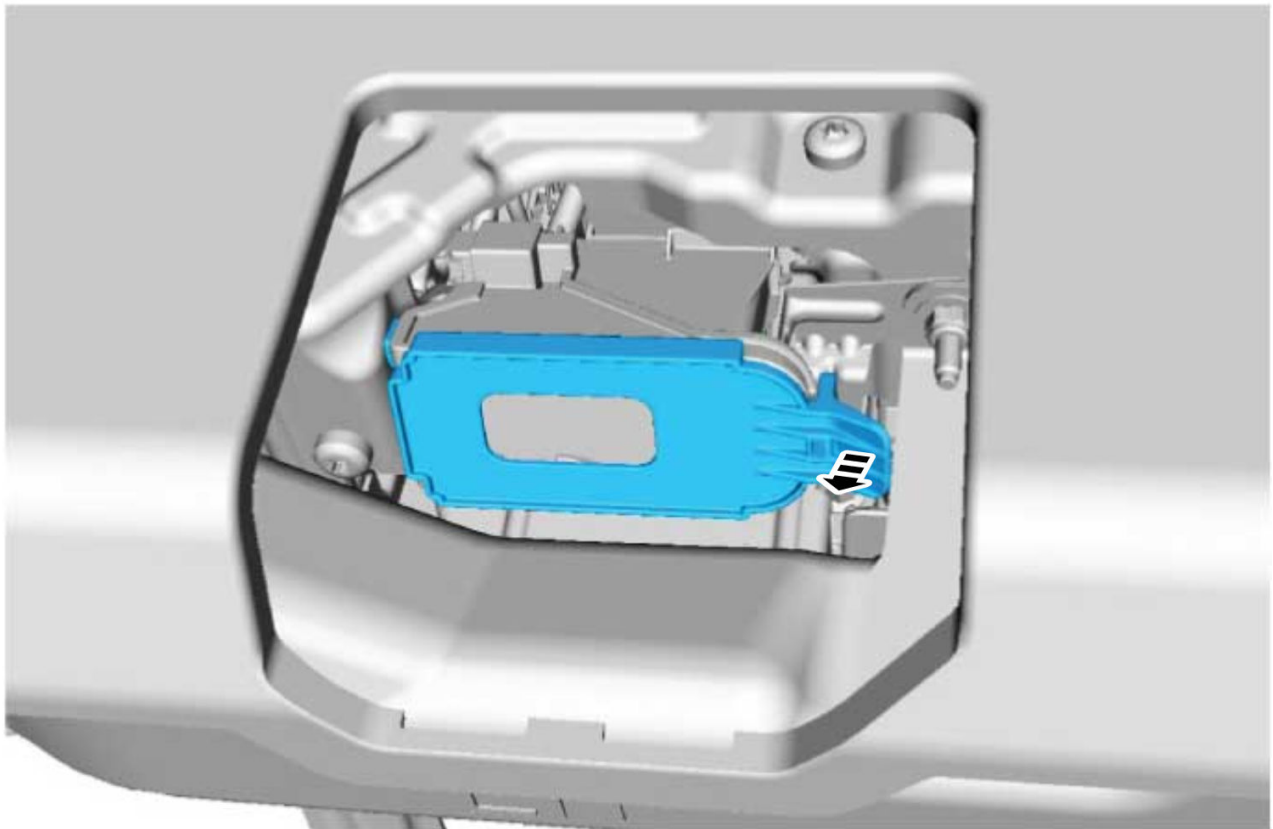
Section 2: High Voltage Battery Depowering



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4. Pull to remove the high-voltage battery service disconnect interlock cover.

Section 2: High Voltage Battery Depowering

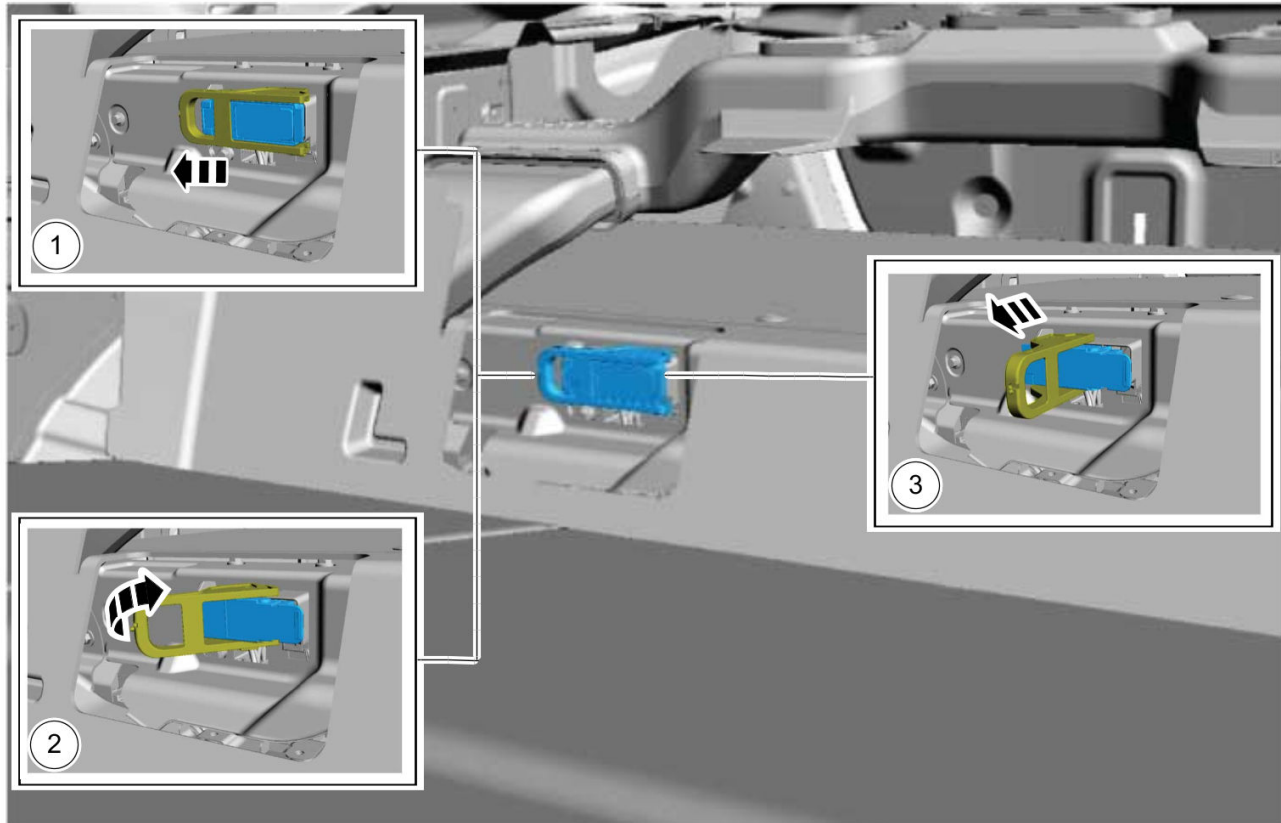


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5. Remove the high-voltage service disconnect:

Pull the Lever Position Assurance (LPA) tab toward the front of the vehicle to remove.
Pull the lever handle outward to disengage the interlock.
Rotate the lever to horizontal and remove the battery high-voltage service disconnect.

Section 2: High Voltage Battery Depowering



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6. Wait 5 minutes after the service disconnect has been removed before continuing service. This allows any residual voltage in the high-voltage system to dissipate.
7. To repower the system, reverse the depowering procedure.

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Section 3: General Electrical Information

Section 3: General Electrical Information

Electrical Basics

Throughout a vehicle, electricity is supplied through "hot" wires, comparable to the pressurized supply pipes of a plumbing system. At various points along the wires are electrical loads in the form of lights, switches and receptacles. Turning on a light switch is somewhat like opening a faucet to let water run; electricity flows through the hot wire to make the light illuminate. Once the electricity has done its work, its potential drops to zero, just as water loses pressure after flowing through a sink or laundry tub. The electrical system has drains, which are the ground wires that return the electricity to its source, just as a plumbing system has drain pipes through which water runs into the sewer mains or ground.

The lights or equipment, technically called the load, can be compared to a water wheel that remains motionless until a stream of water causes it to turn. A load consists of a resistance, a material that permits the passage of electricity, but only with difficulty and thereby creates heat. Resistance to electricity flowing through a wire can be compared to the resistance given to water flowing through a hose, as if the hose were to be squeezed, it would restrict the flow of water. A load may also be inductive, typically a motor with windings of copper wire, in which the magnetic fields generated by the electrical current creates motion. The tungsten filament of an incandescent bulb or the heating element of an electric heater in a coffee pot would be an example of a resistive load. At any moment, the demand on an electrical system depends on the number of loads in operation and their consumption of energy, just as demands on a water system depend on how many faucets are opened and how wide they are opened.

The mechanics and physical fittings of the system are simple. Electricity moves throughout the vehicle in wires of different sizes, according to the electricity a circuit may have to carry.

Electrical Terms

VOLT is the unit of electrical potential, equal to the difference of electrical potential between 2 points in a circuit. It could be compared to the pressure, or the push, on the water to move it through a pipe.

AMPERE or **AMPS** is the unit used to measure the amount of electrical flow; the number of electrically charged particles called electrons that flow past a given point in a circuit. It is similar to measuring the amount of water flowing through a pipe at any given point. The larger the pipe is, the more water that can flow past one given point per second. Similarly, the bigger the wire is, the more electricity that can flow past a given point.

WATT is the unit of power. It indicates the rate at which a device converts electric current to another form of energy, either heat or motion. Or to put it another way, the rate at which a device converts energy.

The relationship of volts, amperes and watts to one another is expressed in a simple equation that enables you to make any calculations you may need for proper and safe electrical modifications to the vehicle. Volts x Amps = watts. If the current is at 12 volts and a device requires 4 amperes of current, the equation will read 12 volts x 4 amperes = 48 watts.

To figure the current needed for a device rated in watts, turn the equation around: Watts/volts = amperes. For example, if you have a piece of equipment, such as a communications radio, that uses 120 watts: 120 watts/12 volts = 10 amperes.

Control Modules — Red Area

Do not install any components into the control modules or module harness. Connecting into this system may affect control module operation. For example, connecting of aftermarket electrical equipment into the brake light circuit or any other circuit which is connected to the PCM, anti-lock brake computer, air bag system or any other vehicle system will cause vehicle malfunction.

Controller Area Network (CAN) Bus

NOTICE:

Wiring faults in the controller area network (CAN) bus may shut down the vehicle and prevent further operation.

Do not splice or connect any equipment to the controller area network (CAN) bus wiring.

General Guidelines For Vehicle Modification

- Provide circuit protection (fuses) for all wiring. The fuse rating should not exceed either the rated wiring current capacity or the total current requirements for all the add-on components on the circuit. Install fuses as close to the point of tapped power as possible.
- Document all revisions to the electrical system and place with the vehicle Owner's Literature. Color code and/or label all revisions or additions to wiring.
- Provide protective covering in all areas that could be damaged during normal equipment installations.
- Disconnect the negative battery cable of vehicles stored on site to reduce the possibility of draining the battery by lights or other equipment.
- Do not allow control panels attached to the instrument panel to protrude into the driver and passenger air bag deployment zones. For additional information, refer to Section 5: Reference Information in this guide.

Section 3: General Electrical Information

- Do not install switches and gauges in the driver or passenger knee impact areas.
- Inspect all Ford gauges, lights and switches for correct operation after instrument panel work is performed.
- Properly secure any relocated or removed wiring while working behind the instrument panel to prevent chafing, squeaks and rattles.
- Provide adequate retention for wiring harnesses so that they are clear of bolts, corners or edges which could abrade the wires during normal vehicle operation.
- Anticipate incorrectly routed wiring situations and protect all wiring from penetration by screws and raw edges.
- Weather-seal all electrical connectors exposed to the elements.
- Do not use quick splice connectors or wire nuts.
- Install the fuse panel so fuses are readily accessible.
- Make sure that connections are easily accessible for assembly and service.
- Make sure submersible connectors do not lose their seals under extreme assembly conditions such as bending wires 90 degrees immediately after the connector.
- Whenever using connectors, use a socket (female) connector on the electrical source side and a plug (male) connector on the electrical load side to reduce the possibility of a short circuit when disconnected.
- Air bag restraint systems must remain intact as received from Ford Motor Company. Before any vehicle modifications are performed, the system must be disarmed by following the instructions provided in the current Workshop Manual.
- Adherence to the above guidelines is not to be construed as approval by Ford Motor Company of any specific revisions or additions to the vehicle's original electrical system.
- Do not modify the cooling system. High-voltage vehicle components may be damaged if any cooling system modifications are attempted.
- Do not backprobe, splice or repair the high-voltage system (orange) wiring/cables.
- Do not mount to or modify the high-voltage system (orange) wiring/cables in any way.
- Do not cut, weld or screw into the HVTB case or penetrate the batteries in any way.
- Air bag restraint systems must remain intact as received from Ford Motor Company. Before modifications are done to the vehicle, the system must be depowered by following the instructions provided in the current Focus Electric Workshop Manual.
- Provide circuit protection (fuses) for all wiring. The fuse rating should not exceed either the rated wiring current capacity or the total current requirements for all the add-on components on the circuit. Install fuses as close to the point of tapped power as possible.
- Provide protective covering in all areas that could be damaged during normal equipment installations.
- Do not allow control panels attached to the instrument panel to protrude into the driver and passenger air bag deployment zones. For additional information, refer to Section 4: Reference in this guide.
- Do not install switches and gauges in the driver or passenger knee impact areas.
- Provide adequate retention for wiring harnesses so they are clear of bolts, corners or edges which could abrade the wires during normal vehicle operation.
- Properly secure all wiring relocated or removed while working behind the instrument panel to prevent chafing, squeaks and rattles.
- Anticipate misrouted wiring situations and protect all wiring from penetration by screws and raw edges.
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- Make sure submersible connectors do not lose their seals under extreme assembly conditions such as bending wires 90 degrees immediately after the connector.
- Whenever using connectors, use a socket (female) connector on the electrical source side and a plug (male) connector on the electrical load side to reduce the possibility of a short circuit when disconnected.
- Adherence to the above guidelines is not to be construed as approval by Ford Motor Company of any specific revisions or additions to the vehicles original electrical system.
- Document all revisions to the electrical system and place with the vehicle Owner's Literature. Color code and/or label all revisions or additions to wiring.
- Disconnect the negative battery cable of vehicles stored on-site to reduce the possibility of draining the battery by lights or other equipment.

12 Volt Battery

The 12 volt battery is a standard automotive battery. It is a DC source connected in a negative ground system. The battery case is sealed, with 2 vent holes to release gases. The battery has 3 major functions:

- Storage of electricity for later use
- Voltage stabilizer for the electrical system
- Temporary power source when electrical loads exceed the DC/DC converter output current

Section 3: General Electrical Information

- Only use the 12 volt (Low Voltage) power point provided in the trunk on the driver side behind the battery access panel. NEVER use the High Voltage Hybrid battery to supply power for law enforcement equipment.

Auxiliary Power Point — 12V



WARNING:

The nominal high-voltage traction battery (HVTB) voltage is 300 volts DC.



WARNING:

The high-voltage traction battery (HVTB) and charging system contains high-voltage components and wiring. High-voltage cables and wiring are orange in color.



WARNING:

Before carrying out any vehicle modifications, the high-voltage traction battery (HVTB) must be depowered. Failure to follow these instructions may result in severe personal injury or death.

NOTE:

Do not use the power point for operating the cigarette lighter element (if equipped).

NOTICE:

Power outlets are designed for accessory plugs only. Do not insert any other object in the power outlet as this will damage the outlet and blow the fuse. Do not hang any type of accessory or accessory bracket from the plug. Improper use of the power outlet can cause damage not covered by your warranty.

To prevent the fuse from being blown, do not use the power point(s) over the vehicle capacity of 12-VDC/180W.

To prevent the battery from being discharged, do not use the power point longer than necessary when the engine is not running.

DC/DC Converter

The DC/DC converter is an air-cooled component that converts high-voltage DC power to low-voltage DC power. It is part of the high-voltage battery pack and maintains an electrical isolation between the 2 DC power systems. This system converts the high-voltage (approximately 300 volts) to low-voltage (12 volts) that provides power to the vehicle low-voltage battery systems. The PCM controls the operation of the DC/DC converter through an enabled input from the PCM to the DC/DC converter.

Vehicle Component Electrical Loads

Vehicle component electrical loads are shown in the table below. Not all features are powered all the time, so actual vehicle loads on the power supply system will vary.

NOTE:

The electric A/C compressor loads are included with the blower loads.

Component	Amps
Base	
Miscellaneous base loads	16.5
Cooling	
Cooling fan (high speed variable)	27.0
Climate Control	
A/C fan to face — high speed (recirculating air)	25.0
A/C fan to face — M/H speed (recirculating air)	16.0
Heater fan to foot — M/H speed (fresh air)	16.0

Section 3: General Electrical Information

(Continued)

Component	Amps
Lighting	
Exterior and instrument panel lamps (non-dimmable)	3.5
Headlamps — low beam	9.1
Brake lights (with CHMSL)	5.1
Heated Features	
Heated rear window (includes heated mirrors)	18.0
Heated front seat — LH	4.5
Heated front seat — RH	4.5
Other	
Radio	4.0
Typical Vehicle Load = 95-110 Amps	

Typical Police Equipment

Loads for equipment commonly found on police vehicles are shown in the table below. Not all equipment will be operating at the same time, so actual loads on the power supply system will vary.

Component	Amps
Communications radio	5.0-20.0
Light bar	28.0-43.0
LED light bar	6.0
Siren	15.0-30.0
Headlamp flasher	1.0-1.5
LED deck bars/LED visor lights	2.0
Radar	0.8
Receipt printer	3.0
Spotlights (each)	7.8
Alley lights (each)	1.0
Camcorder	2.0

Hybrid Responder — Rear Power Access

The rear power access point is a battery access port for police auxiliary equipment mounted in the trunk. It is capable of supplying 80 amps of battery voltage. Voltage to the positive terminal of the rear power access point is supplied through two 50A fused circuits crimped together, connected to the battery through under hood battery junction box (BJB) fuses #1 and #2. Battery access is provided by 2 studs contained in an enclosure, mounted in the trunk behind the carpet, on the driver side fender support. The terminal with the red wire is the battery positive. Remove both fuses in the BJB before removing the cover to the rear power point. Make sure load devices can be turned off and are switched off when reinserting the fuses.



WARNING:

Under no circumstance should the rear power access point cover be removed without first removing the battery junction box (BJB) fuses #1 and #2. Removing the cover without removing the fuses could result in an electrical hazard. Turn off load devices before inserting the fuses. Failure to follow these instructions may result in personal injury.

Section 3: General Electrical Information

Hybrid Responder — Rear Power Access

The rear power access point is a battery access port for police auxiliary equipment mounted in the trunk. It is capable of supplying 80 amps of battery voltage. Voltage to the positive terminal of the rear power access point is supplied through two 50A fused circuits crimped together, connected to the battery through under hood battery junction box (BJB) fuses #1 and #2. Battery access is provided by 2 studs contained in an enclosure, mounted in the trunk behind the carpet, on the driver side fender support. The terminal with the red wire is the battery positive. Remove both fuses in the BJB before removing the cover to the rear power point. Make sure load devices can be turned off and are switched off when reinserting the fuses.



WARNING:

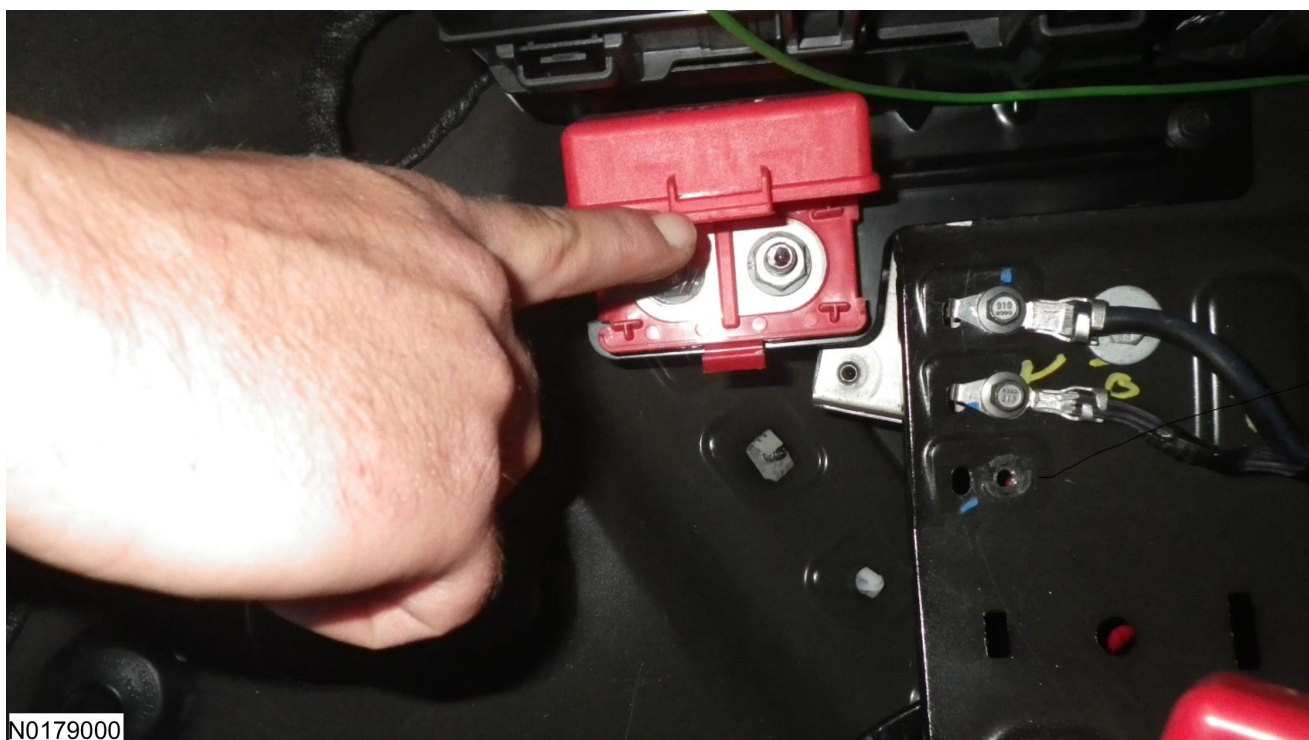
Under no circumstance should the rear power access point cover be removed without first removing the battery junction box (BJB) fuses #1 and #2. Removing the cover without removing the fuses could result in an electrical hazard. Turn off load devices before inserting the fuses. Failure to follow these instructions may result in personal injury.

1. It will be necessary to remove the battery access panel located in the trunk on the left side of the vehicle, to access the rear power point.



2. Remove the cover.

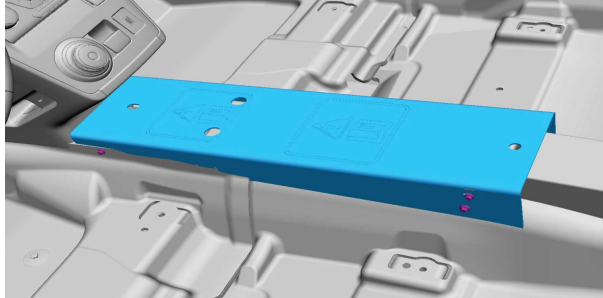
Section 3: General Electrical Information



Access to Signals and Power

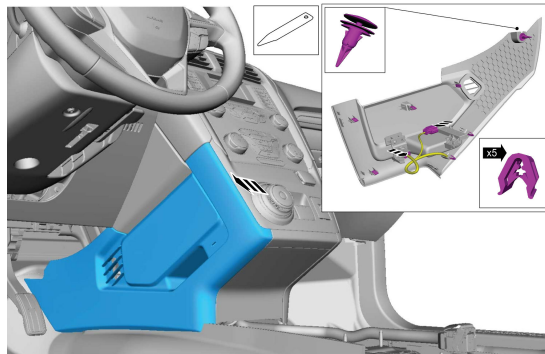
1. Remove six bolts and the mounting plate.
 - a. Torque: 55 lb.in (6.2 Nm)

Section 3: General Electrical Information



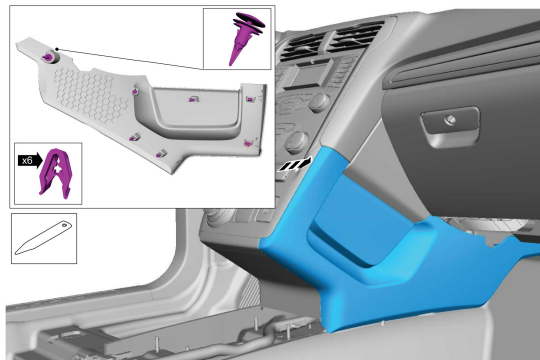
N0179076

2. Release the clips and remove the LH (left-hand lower trim panel).



N0179077

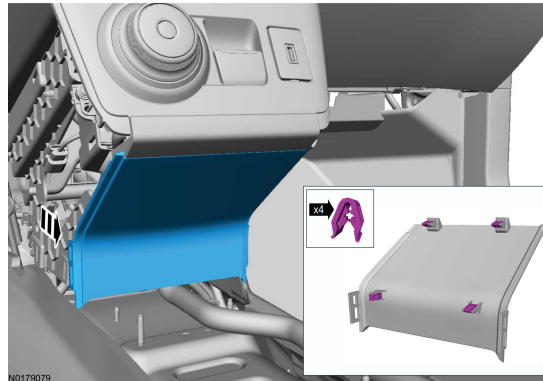
3. Release the clips and remove the RH (right-hand lower trim panel).



N0179078

4. Release the clips and remove the center lower trim panel.

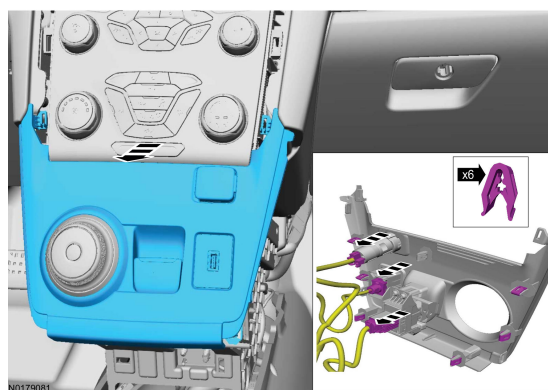
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5. Release the clips and remove the center stack trim panel.

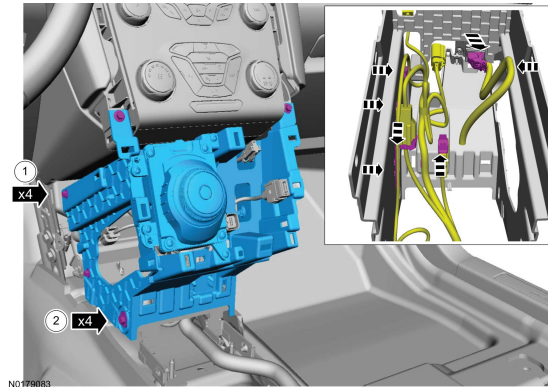


6. Release the clips and remove the selector trim panel.
 - a. Disconnect the electrical connectors.

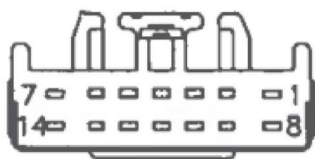
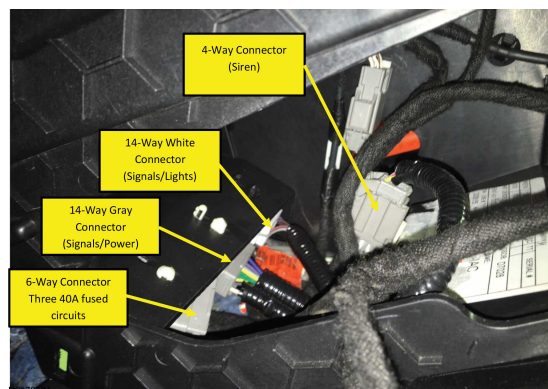
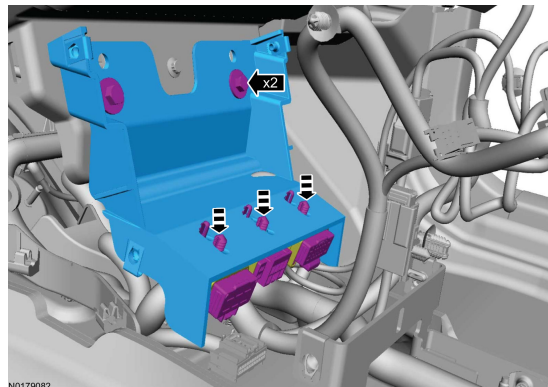


7. Remove bolts, disconnect the electrical connectors, release the harness retainers and remove the selector mounting bracket.
 - a. Remove the bolts
 - (1) Torque: 30 lb.in (3.4 Nm)
 - b. Remove the bolts
 - (1) Torque: 42 lb.in (4.8 Nm)

Section 3: General Electrical Information



8. Remove the bolts, detach the harness and remove bracket.



Part# 3U2Z-14S411-BJAC



Part# 3U2Z-14S411-HEA

Section 3: General Electrical Information

Connector View For Connector 3U2Z-14S411-HEA (continued on the next page).

Pin Number	Description	Wire Color
1	B+ (40A)	BU-RD
2	B+ (40A)	GN-RD
3	B+ (40A)	GY-RD
4	Ground	BK-WH
5	Ground	BK-WH
6	Ground	BK-WH

Connector View For White Connector 3U2Z-14S411-BJAC.

Pin Number	Description	Wire Color
1	Side View Mirror Lights	VT
2	Grille Lights	BN
3	Start	
4		
5		
6	Front Light Switch	BU/GN
7	Dimmer	VT
8	Brake Output	VT-WH
9	Front Aux And Grille Lights	BN
10		
11	Battery Saver	YE-GN
12	Rear Wig-Wag Module	GY-RD
13	Audio Mute	GN-WH
14	Front Flash Pattern	GN-VT

Connector View For Gray Connector 3U2Z- 14S411-APA (continues on the next page).

Pin Number	Description	Wire Color
1	B+ Feed #1	GN-RD
2	Control Button 1	GY-BN
3	Control Button 2	WH-VT
4	Control Button 3	GN-BN
5	Control Button 4	YE-GY
6	Police Start In	YE-OR
7	Trunk Cooling Fan	WH-BN
8	B+ Feed #2	GY-RD
9	Vehicle Speed	VT-OR
10	Delay Accessory	BN-YE

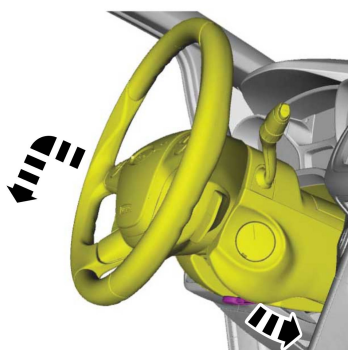
Section 3: General Electrical Information

(Continued)

11	B+ Feed #3	RD
12	Park Detect	WH-GN
13	Driver Door Ajar	GN-VT
14	Front Wig Wag Module	BN

Horn Ring Circuit

1. Fully extend and lower the steering column.

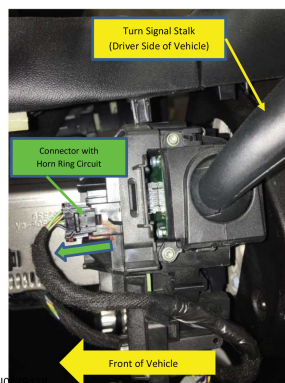


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2. Remove the lower steering column shroud and the lower steering column shroud.

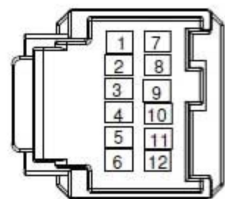


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Section 3: General Electrical Information



CU5T-14489-LA

N0179119

Pin	Description	Wire color
1	Horn Ring Circuit	GN-WH

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Section 4: Vehicle Sealing and Vehicle Decommissioning

Section 4: Vehicle Sealing and Vehicle Decommissioning

Upfitter Sealing Pass-Through Points/Openings

Aftermarket upfit modification of Hybrid Responder Sedan vehicles can result in openings that allow external air and its contents to enter the vehicle that have not been sealed to original design intent.

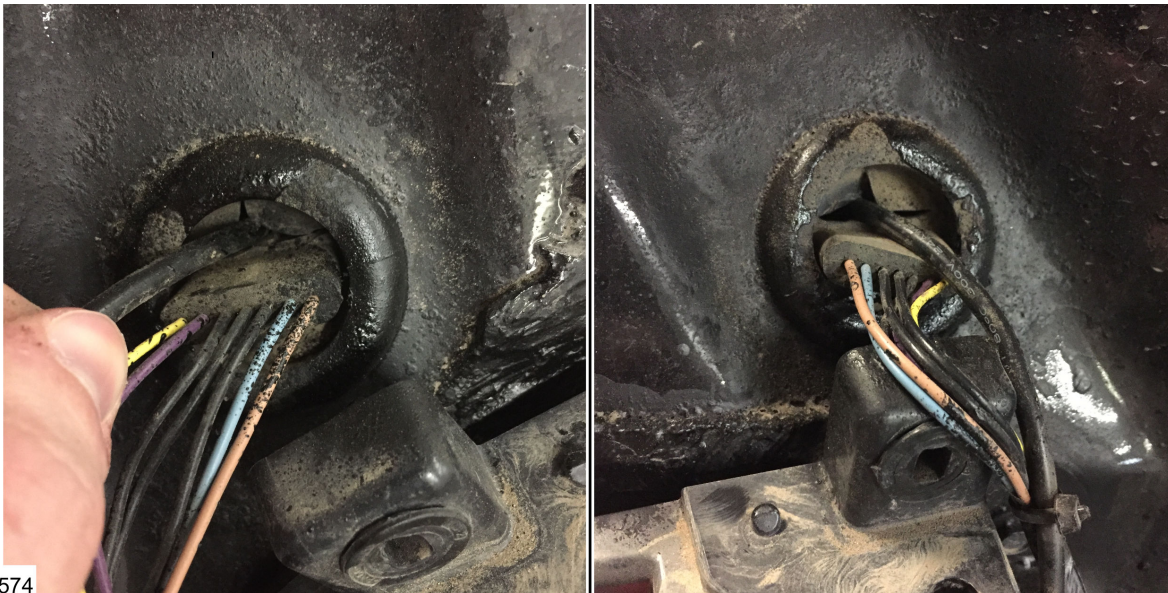
Examples of openings in some areas that were not properly sealed and allowed external air and its contents to enter the trunk area. Proper care and due to diligence must be used on all openings at any location on the vehicle from the dash panel to the rear of the vehicle.

Any and all holes created or existing grommets affected during upfit which are exposed directly or indirectly to outside air MUST be completely sealed using Motorcraft® Seam Sealer (TA-2-B).

Sealing Pass-Through Points/Openings

Some Examples from a Utility Police Interceptor That are not properly sealed are shown in the following:

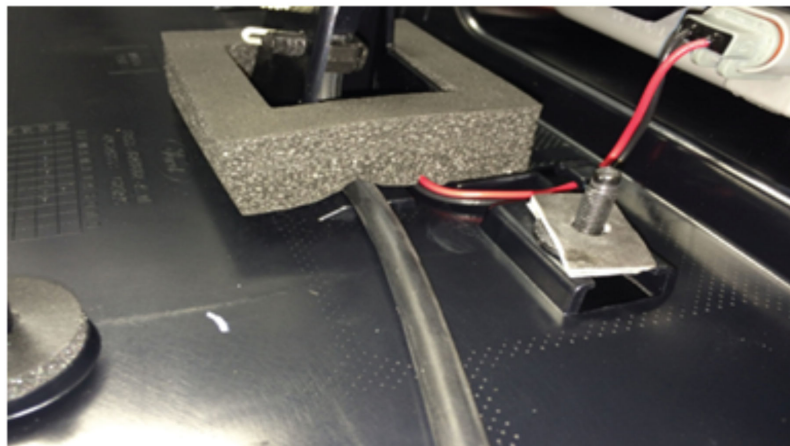
- Any holes in the rear of the vehicle must be sealed.
- Wiring passing through sheet metal and/or existing grommets behind the passenger and driver side tail lamps must be fully sealed using Motorcraft® Seam Sealer (TA-2-B)



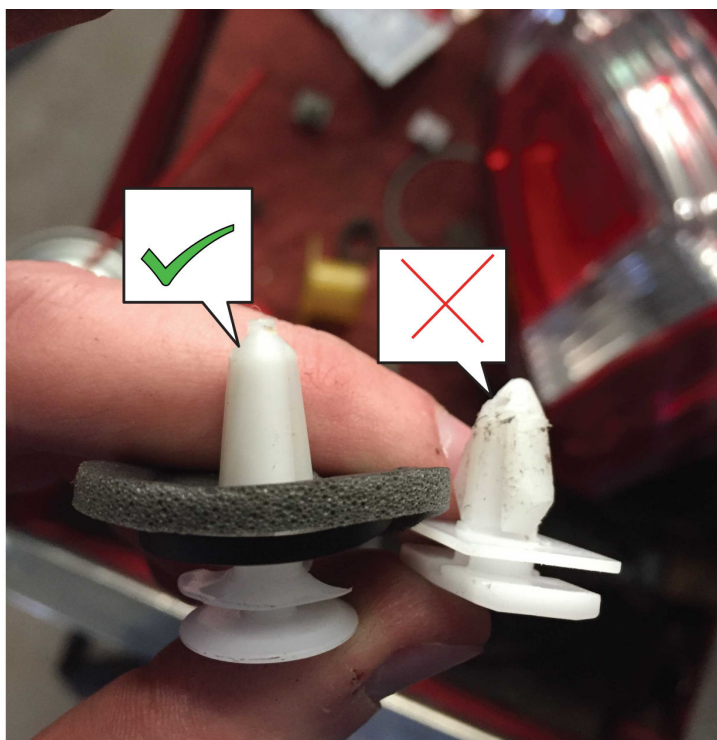
Rear Spoiler Remove And Install

- Removal of the rear spoiler requires thorough sealing upon reinstallation.
- Inspect the foam tower seal and ensure that the wiring and washer line are properly routed and are not compromising the sealing interface. (Figure 3)
- Repair and/or re-seal as necessary using Motorcraft® Seam Sealer (TA-2-B).
- Replace any damaged plastic retainer clips with close attention to the foam gaskets. Repair any deformed sheet to ensure a good seal

Section 4: Vehicle Sealing and Vehicle Decommissioning



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N0179156

Trunk/Decklid Openings/Holes

Any holes in the Trunk area of the Hybrid Responder Sedan must be sealed with Motorcraft® Seam Sealer (TA-2-B).

If the Decklid seal is damaged it should be replaced.

Section 4: Vehicle Sealing and Vehicle Decommissioning



N0179157

Sealing Pass-Thru Points/Openings

Liftgate Bulb Seal

- If the light bulb seal is damaged, or is removed for any reason, it should be replaced and properly seated.
- If the trunk is damaged, or is removed for any reason, it should be replaced and properly seated.

Underbody

- Any holes in the body must be sealed with Motorcraft® Seam Sealer (TA-2-B).
- Any damaged parts must be replaced. Following are some examples:
- spare tire tub
- auxiliary A/C pass-through
- air extractors (replace if damaged)
- wiring grommets
- body plugs
- floor pan

Dash Panel

Any seals and/or holes in the dash panel must be replaced and/or properly sealed using Motorcraft® Seam Sealer (TA-2-b).

Sealing Option For Body Openings/Pass-Through Points

- Pass-through or other openings of similar size should be sealed using the recommended foil-backed mastic patch.
- Foil-backed mastic patch should be used to cover and seal body openings.
- Part number for foil-backed mastic patch:
- Following are service part numbers for two different size foil-backed mastic patches:
- 4L3Z18203A16AA; size of patch - 1.5 x 147 x 330 mm
- DA5Z65203A16A; size of patch - 1.5 x 100 x 300 mm

Section 4: Vehicle Sealing and Vehicle Decommissioning

Decommissioning

Vehicle Sealing of Aftermarket Equipment

At the end of its useful life as a police vehicle, many vehicles are decommissioned having lights, wiring and other equipment removed and vehicles are sold for other uses such as retail applications. The openings remaining in the body/components are potential leak paths for exhaust gas into the cabin under certain conditions. These openings must be sealed prior to the vehicle going to auction or any other application.

When customized equipment has been removed from your vehicle, body panels and seals may be compromised. Thoroughly inspect your vehicle for any signs where the equipment has been removed, for example: holes and damage to body seals.

Any openings should be sealed with a plug and a sealant. The opening can be modified to enable a plug to seat properly promoting a better sealing surface. The sheet metal surface with the opening should be treated to prevent corrosion prior to inserting the plug and sealant.

Any items that remain on your vehicle must be inspected and any sign of damage repaired immediately. Failure to follow this instruction may result in water and exhaust fumes entering the passenger compartment.

See your authorized Ford dealer for more information and direction regarding proper sealing procedures.



N0178256

Common Ford Plug Part Number	Hole Diameter
W716284-S	0.859 inches / 21.83 mm
W714104-S	1.07 inches / 27.25 mm
W711539-S	1.378 / 35.0 mm
W651021-S	1.683 inches / 42.75 mm

Tools For Creating A Circular Opening

Two suggestions for tools that can be used for creating and/or modifying an existing opening for a plug are a Knockout Punch or Step Bit.



N0178257



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Section 5: Electrical

Section 5: Electrical

Control Modules — Red Area

Do not install any components into the control modules or module harness. Connecting into this system may affect control module operation. For example, connecting of aftermarket electrical equipment into the brake light circuit or any other circuit which is connected to the PCM, anti-lock brake computer, air bag system or any other vehicle system will cause vehicle malfunction.

Controller Area Network (CAN) Bus

NOTICE:

Wiring faults in the controller area network (CAN) bus may shut down the vehicle and prevent further operation.

Do not splice or connect any equipment to the controller area network (CAN) bus wiring.

General Guidelines

- Do not modify the cooling system. High-voltage vehicle components may be damaged if any cooling system modifications are attempted.
- Do not backprobe, splice or repair the high-voltage system (orange) wiring/cables.
- Do not mount to or modify the high-voltage system (orange) wiring/cables in any way.
- Do not cut, weld or screw into the HVTB case or penetrate the batteries in any way.
- Air bag restraint systems must remain intact as received from Ford Motor Company. Before modifications are done to the vehicle, the system must be depowered by following the instructions provided in the current Focus Electric Workshop Manual.
- Provide circuit protection (fuses) for all wiring. The fuse rating should not exceed either the rated wiring current capacity or the total current requirements for all the add-on components on the circuit. Install fuses as close to the point of tapped power as possible.
- Provide protective covering in all areas that could be damaged during normal equipment installations.
- Do not allow control panels attached to the instrument panel to protrude into the driver and passenger air bag deployment zones. For additional information, refer to Section 4: Reference in this guide.
- Do not install switches and gauges in the driver or passenger knee impact areas.
- Provide adequate retention for wiring harnesses so they are clear of bolts, corners or edges which could abrade the wires during normal vehicle operation.
- Properly secure all wiring relocated or removed while working behind the instrument panel to prevent chafing, squeaks and rattles.
- Anticipate misrouted wiring situations and protect all wiring from penetration by screws and raw edges.
- Weather-seal all electrical connectors exposed to the elements.
- Do not use quick splice connectors or wire nuts.
- Install the fuse panel so fuses are readily accessible.
- Make sure that connections are easily accessible for assembly and service.
- Inspect all Ford gauges, lights and switches for correct operation after instrument panel work is performed.
- Make sure submersible connectors do not lose their seals under extreme assembly conditions such as bending wires 90 degrees immediately after the connector.
- Whenever using connectors, use a socket (female) connector on the electrical source side and a plug (male) connector on the electrical load side to reduce the possibility of a short circuit when disconnected.
- Adherence to the above guidelines is not to be construed as approval by Ford Motor Company of any specific revisions or additions to the vehicles original electrical system.
- Document all revisions to the electrical system and place with the vehicle Owner's Literature. Color code and/or label all revisions or additions to wiring.
- Disconnect the negative battery cable of vehicles stored on-site to reduce the possibility of draining the battery by lights or other equipment.

Equipment Grounding Guidelines

- Do not ground the body to the transmission or transmission crossmember. Ground accessories to the chassis or the vehicle battery.
- Splicing into circuitry relating to the electronic engine and/or transmission control systems is not acceptable because of the adverse effect on the electronic system operation.
- Adequately protect electrical connections exposed to the elements.

Wire Insulation

- Polyvinyl chloride (PVC) rated at 90°C (194°F) is the standard wire insulation acceptable for inside body use but is not acceptable for underhood/underbody wiring.

Section 5: Electrical

- Hypalon insulation should be used on links only (Ford specification ESB-M1L54-A).
- Cross-linked polyethylene (XLPE or SXL) rated at 125°C (257°F) is the required insulation for underhood/underbody applications (Ford specification ESB-M1L123-A).
- GXL can be used as an alternate wire (Ford specification ESB-M7L85B) as long as the concentricity specifications are met. To provide a water-resistant seal in conjunction with crimp connectors, a Duraseal® crimp connector is recommended since it is designed to account for outside wire diameter that is smaller than the present SXL wire.

Terminals and Connectors

Connector Types:

- Submersible (sealed) — A connector that is capable of being immersed in water.
- Weather-resistant — A connector that will retain its sealing and connection qualities while being exposed to adverse weather conditions.
- Duraseal® crimp — A supplier trade name for a sealed wiring repair or splice.

When a connection is not defined (typical situation — harness-to-harness connectors), the following suggestions should be implemented:

- Determine the connector type. If it will be located in a hostile environment, use a sealed connector; if not, use an open connector. A hostile environment is defined as being exposed to water and/or salt accumulation and/or high temperatures (that is; underhood, exterior panels and footwells). Use in-line connectors with secondary locks to prevent the terminal from being pushed out.
- Do not use single wires smaller than 14 gauge in a 2-way or larger weather-resistant connector (the very large style), since the wire may break during disengagement.
- Use Hypalon, XLPE or Elexar insulation in submersible connectors to maintain sealing integrity. PVC is not acceptable because its properties allow it to set in a deformed pattern, therefore compromising the integrity of the seal.
- Determine the terminal type. Base your decision on wire gauge, current carrying capacity, connector type and insulation type.
- Use non-detent low insertion force terminals whenever possible.
- Do not use low insertion force female terminals in weather-resistant connectors.
- Analyze circuit requirements (signal levels, current, voltage) to determine the proper plating material (such as gold). Use of non-plated terminals is not recommended.
- Do not use plugs to seal holes in micropin connector grommets. It is very easy to forget to insert them during manufacturing and ruin the seal. Use a grommet with only the necessary number of holes or use dummy wires at least 600 mm (24 in) long.
- Fully align connectors prior to terminal connection — terminal cavities should have minimum tolerance to prevent terminals from floating, bending or pin push-out during mating/engagement.
- Make sure connectors of similar type and color are identifiable to the operator to eliminate crossed connections and minimize assembly time. Avoid using similar types and colors of connectors close together.
- Be sure that connectors have positive locking devices that allow easy installation with a low insertion force and easy removal. The connector snap should be easily felt and heard.
- Eliminate the use of edgeboard, tang-type and molded-over connectors. The use of blade-type weather-resistant connectors is restricted to high-current applications which cannot be handled by submersible connectors.

Circuit Protection and Electrical Load

- Modification to the vehicles existing low-voltage (12 volts) wiring should be done only with caution and careful consideration of effects on the completed vehicles electrical system. Anticipated circuitry should be studied to determine the required circuit protection and to avoid feedback loops.
- Added circuitry must be protected either by a base vehicle fuse or circuit breaker, or by a similar device supplied by the modifier.
- When adding loads to a base vehicle-protected circuit, make sure the total electrical load through the base vehicle fuse or circuit breaker is less than the devices load rating.
- Use 80% of the fuse rating to determine maximum steady state load to reduce nuisance fuse failures.
- Use 135% of the fuse rating when sizing wiring to protect the circuit in the event of an overload. Fuses will last for one hour at 135% of their rating.
- Total current draw is the sum of the base vehicles circuit current requirement (measured with an ammeter) and the anticipated add-on component current requirements.
- Never increase the rating of a factory installed fuse or circuit breaker.
- If the total electrical load including additional electrical components, on any circuit, is less than the fuse protection rating or the capacity of some limiting component (switch, relay), the items to be added can be connected directly to that circuit. The headlamp switch circuits should never have additional lighting or electrical components directly connected.
- Added devices that exceed the current capabilities of the factory-installed system are best controlled through the use of a relay or separate switch. The coil of the relay can be fed from the circuit in the factory harness (now acting as a signal circuit) with added wiring providing feeds to the added electrical device. The relay selection is important and depends on current requirements, number of cycles expected in the relay lifetime, whether the relay is to be operated intermittently or for long periods of time and whether the relay is exposed

Section 5: Electrical

to weather conditions or is installed in a protected area. When the current requirements of a circuit exceed the capacity of an available relay, the load should be reduced or divided through the use of additional relays.

Wire Protection Requirements

General Notes

- Anticipate problems and design accordingly. Try to anticipate what could go wrong and modify your designs to address any adverse impact.
- Review all connector applications and electrical systems to determine the need for solder, grease, weather-resistant or sealed connectors. Make sure components and wire insulation are compatible with greased connectors (important for long-term durability).
- Make sure that drip loops or other means are provided to prevent water leakage into the vehicle through wiring assemblies that pass through the dash panel.
- Use greased or sealed connectors in floor pan troughs which are subject to moisture coming through the carpeting.
- Use XLPE insulation for uncovered runs that exceed 305 mm (12 in).

Electrical Protection

- Properly route wires away from noise-generating wires or components. However, if routing near noisy wires or plugging into noisy components is unavoidable, design additional protection into the harness.
- Electromagnetic interference (EMI) shielding — Consider shielding if you must route close to high-current or noisy circuits. Use shielded wire and ground one side. Seal all splices in wire assemblies that use bare coaxial shielding (braid or tape) for EMI suppression, and insulate or tape over all shielding ends that terminate near any open connectors. This prevents splice and terminal shorts to the shielding. Minimize the length of conductors which extend beyond the shield. Failure to do this reduces the effectiveness of the shield.
- Spike suppression, in general, is accomplished by connecting a diode or resistor-diode combination across the terminals of the noisy component. The diode should be sufficiently close to the component (both electrically and physically) so that inductive spikes are clamped off. Make sure the diode is connected with the proper polarity.

Proper routing and retention reduces the likelihood of chafing or pinching. When this ideal routing is unattainable, the following additional protection is needed:

Mechanical/Environmental Protection

NOTE:

This is not meant to be an all-inclusive list of methods for physically protecting the wires. There are other means of protection available that are not listed.

- Tape — Tape is the most basic means of protection. It contains the wires in a loose bundle and provides limited environmental protection. It does not protect against chafing and pinching.
- Kendall polyken fiberglass base tape (Ford specification ESB-M3G38-A) is used for engine compartment applications. This durable tape provides protection against cut-through and abrasion commonly found in underhood applications.
- Polyken 267 is a substitute tape that may be used in lower temperature areas of the engine compartment (apron area).
- Convolute — Use convolute for all underhood/underbody applications or when increased temperature, abrasion or pinch resistance is required. Convoluted tubing comes in different diameters and materials to accommodate different temperature ranges and harness sizes.
- Use polyethylene convolute when abrasion is the only consideration; this convolute is adequate up to 96°C (205°F) maximum. Use nylon convolute when underhood/underbody or abrasion and temperature are considerations; nylon convolute is adequate up to 177°C (350°F) maximum.
- On all engine-mounted wiring or bend points, use vinyl tape on the outside of the convolute to prevent wiring from looping out. This tape must be able to withstand temperatures 135°C (275°F) or higher.
- Tape convolute junctions with abrasion-resistant tape (Polyken 267, fiberglass).
- Scroll — Similar to convolute, but without the ridges. Scroll is used where harness rigidity is required, especially for maintaining critical locator dimensions. Use scroll for short lengths only, as it is inflexible.

Grommets and Sealing Requirements

Any additional wiring routed through sheet metal must pass through a grommet that both seals the opening and locates the wire(s). Two-piece grommets (rubber with plastic inserts) are recommended to facilitate installation and retention.

- Locate grommets so they are accessible for proper seating (achieved by pulling) in sheet metal holes.
- Ramp grommets at the insertion end to facilitate installation and sealing.
- Be sure the direction of the hole punch is in the direction of grommet seating and the hole is burr-free.
- Make sure the grommet molding compound adheres to the harness to prevent slippage.

Section 5: Electrical

- Make sure the grommet will withstand the environment (temperature, splash).
- Be sure the holes are large enough to allow the installation of the harness without causing circuit damage.
- Use adhesive tape on main trunks or branches with at least a 50% overlap to prevent wicking through grommets. Be certain to diaper-wrap the takeouts.

Wire Routing

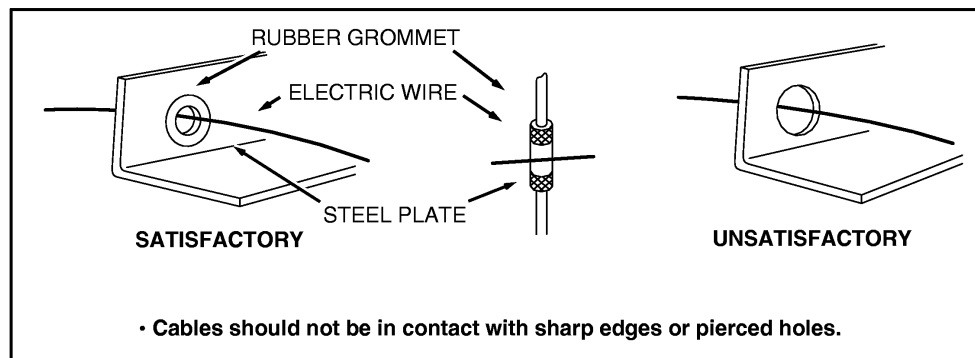


WARNING:

Do not place electrical component attachments or ground screws adjacent to vehicle fuel tanks, fuel filler pipes, fuel lines, fuel vapor lines or carbon canisters. Failure to follow these instructions may result in severe personal injury in the event of a collision.

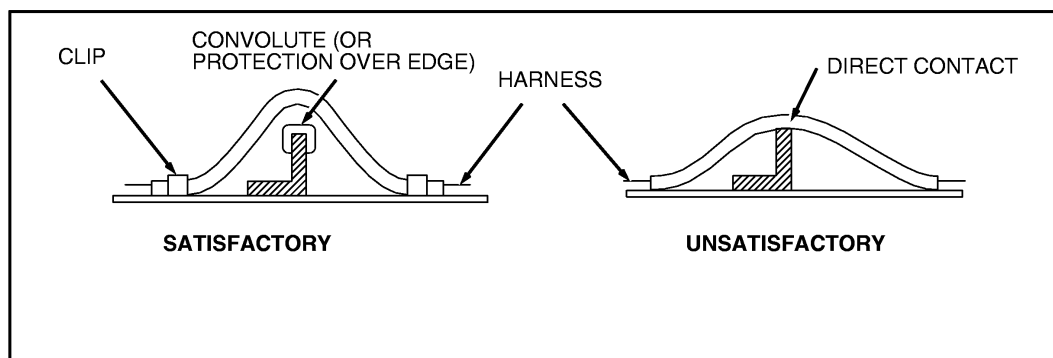
Wire harness routing should conform to the following:

- Protect wires routed through holes in sheet metal or castings with a grommet whether or not conduit is used (see figure below).



A0073515

- Route wires to avoid metal edges, screws, trim fasteners and abrasive surfaces. When such routing is not possible, use protective devices (shields, caps) to protect the wires. Cover metal edges with a protective shield and fasten the wiring within 76 mm (3 in) on each side of the edge (see figure below).



A0073514

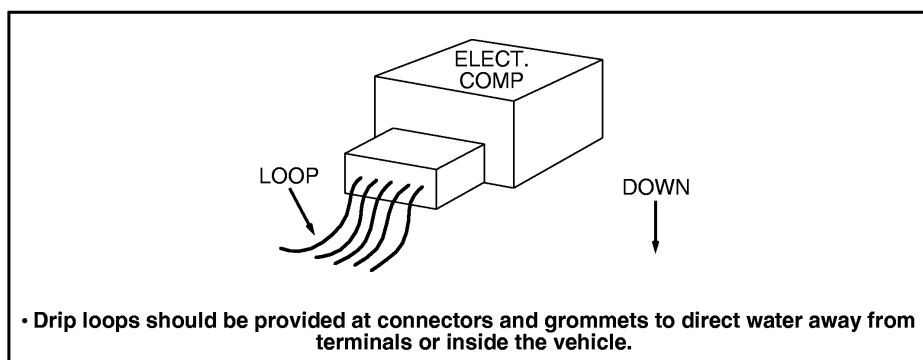
- Route wires to provide at least 76 mm (3 in) of clearance to moving parts in their extreme movement location, unless positively fastened and protected by conduit.
- Avoid wire routing without conduit in areas where temperatures exceed 82°C (180°F). Heat insulation and heat shields must be used on the wires routed in high-temperature areas.
- Make certain that all underhood or underbody wiring is cross-linked polyethylene high-temperature insulation wire 135°C (275°F) (minimum rating) consistent with SAE specification J1128 Type SXL wire. Normal PVC wire must not be used in underhood or underbody applications.
- Make sure all ground locations are readily accessible for installation, service and verification.
- Do not place ground attachments in high-splash areas.
- Underhood/underbody wiring must be routed in conduit for protection. Minimum conduit rating is 177°C (350°F).

Section 5: Electrical

Wire Retention and Routing

Use the following criteria to determine the location of retainers:

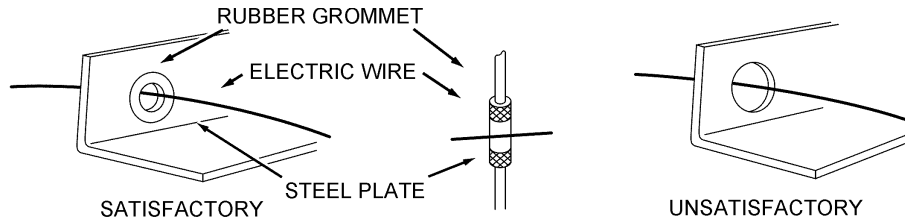
- Size and weight of wire bundle.
- Holes with poor accessibility that prevent installation of locators.
- Movement of wires that can result in abrasion, squeaks and rattles.
- When wiring is routed between 2 members where relative motion can occur, the wiring should be secured to each member with enough wire slack to allow flexing without damaging the wire.
- Wiring exposed to weather must provide a drip loop to prevent moisture from being conducted into the device through the wire connection (see figure below).



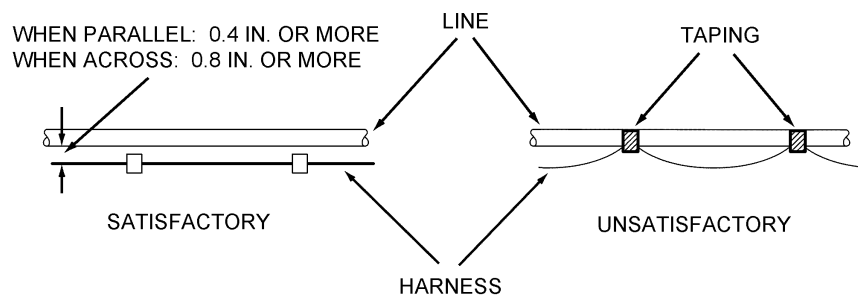
A0073517

- Avoid routing wires into areas exposed to wheel splash. When such routing cannot be avoided, adequate clipping and/or protective shields are required to protect the wires from stone and ice damage. Allow adequate slack in wiring between the engine and stationary components to compensate for engine roll.
- Avoid routing wires under the frame side members or at points lower than the bottom frame flange.
- Use plastic zip straps for bundling only (securing to other wires).
- The wire retainers and grommets installed by the assembly plant are usually designed to accommodate only the Ford-installed wires. Additional wiring or tubing should be retained by additional clips. When added wires or tubes are routed through sheet metal panels, use new holes with proper wire protection and sealing.

Section 5: Electrical



- Cables should not be in contact with sharp edges or pierced holes.



- Harnesses should not be taped to fuel lines or other lines. A sufficient clearance should be maintained between harness and lines.

N0070449

For retainer screws, the following guidelines apply:

- Avoid using fasteners that are too long for the application or are in an area which might damage vehicle components, including wiring, brake lines, fuel tank and lines, powertrain components, exhaust system and suspension.
- Do not use pointed screws for attachments. Make sure that screws used in the vicinity of the wiring are blunt-ended.
- To minimize the potential for wiring shorts, do not use drill point screws. Trim components (including wiring shields) should use pin-type attachments instead of screws.
- Always check areas that screws protrude into for verification that an interference condition to other components does not exist.
- Make sure that retainers used are capable of withstanding the environment over the vehicle's life expectancy.

Splices and Repairs



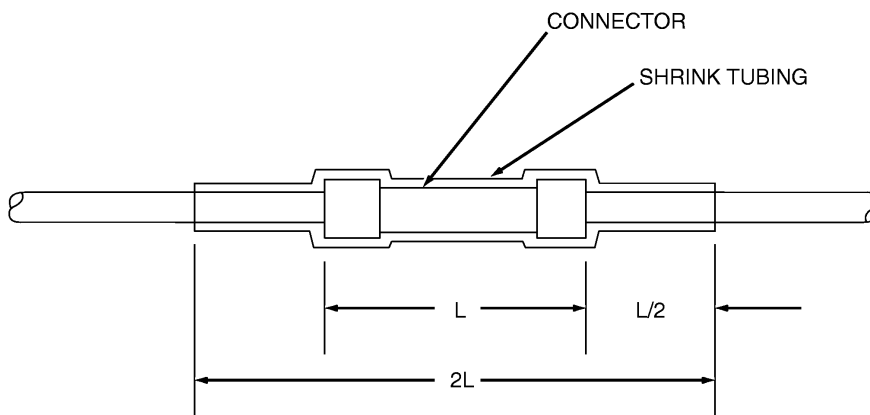
WARNING:

Do NOT splice into or repair high-voltage (orange) wiring/cables. The high-voltage in this system is approximately 300 volts DC. Failure to follow these instructions may result in severe personal injury or death.

- Stagger the splices within a harness to reduce increased harness diameter. Splice only on straight areas as installed, not on bends.
- Strip wire ends, making sure that individual conductor strands are not damaged.

Section 5: Electrical

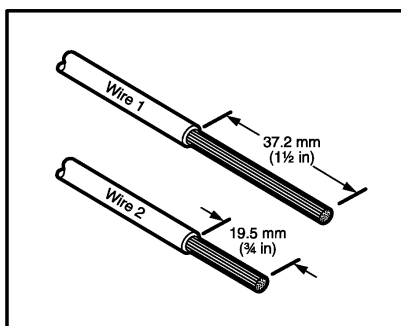
- When soldering, make sure an adequate mechanical joint exists before applying solder. Use only resin-core solder. Acid-core solder should not be used since it may result in corrosion.
- For crimp joints, use butt-type metal barrel fasteners and the proper tool at the appropriate setting for the wire size (such as Motorcraft® Crimp Tool S-9796) specifically designed for this type of work.
- Make sure splice joints are adequately sealed and insulated. In an outside environment, use Duraseal® butt connectors or equivalent. A durable substitute splice joint can be achieved by using a bare metal barrel, crimping, flow-soldering and covering with shrink tubing. Quality electrical tape can be used inside the vehicle but is not recommended for an outside environment.
- Make sure the new wire is not a lesser gauge than its original mating wire.



A0074039

Recommended Splicing Method — Solder (For 16 AWG and Smaller Diameter Wire Only)

1. Disconnect the battery ground cable.
2. Strip wires to appropriate length.

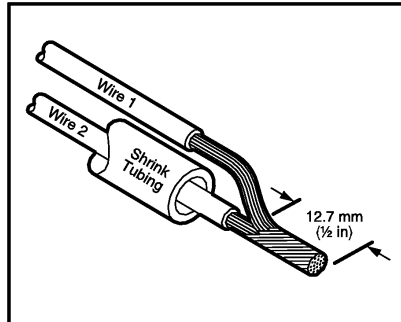


A0075761

3. Install heat shrink tubing.
4. Twist the wires together.
5. **NOTE:**
Use resin-core mildly-activated (RMA) solder. Do not use acid-core solder.

Solder wires together.

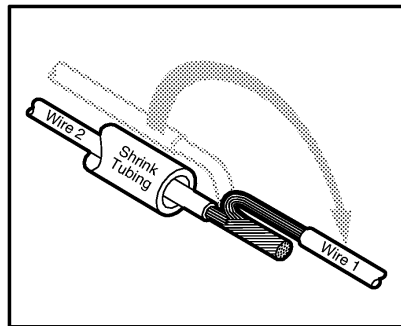
Section 5: Electrical



A0075762

6. **NOTE:**
Wait for solder to cool before moving wires.

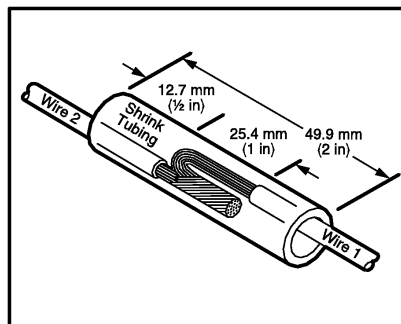
Bend wire No. 1 back in a straight line.



A0075763

7. **NOTE:**
Overlap tubing on both wires.

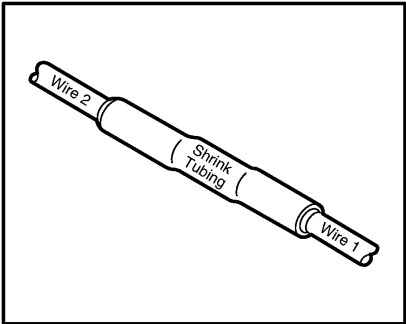
Evenly position heat shrink tubing over wire repair.



A0075764

8. Use a shielded heat gun to heat the repaired area until adhesive flows out of both ends of heat shrink tubing.

Section 5: Electrical



A0075765

9. Reconnect the battery ground cable.

Sealed Connectors

Ford Part Number	Part Name	Class
E6FZ-14488-A	Butt Connector Gauge: 18-22, Color: Red	C
E6FZ-14488-B	Butt Connector Gauge: 14-16, Color: Blue	C
E6FZ-14488-C	Butt Connector Gauge: 10-12, Color: Yellow	C

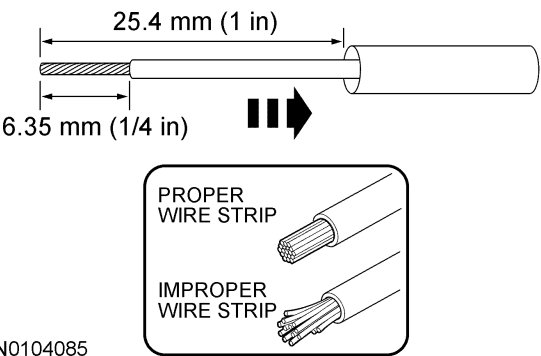
Heat Shrinkable Tubing (Heat Shrink) (Ford Specification ESB-M99D56-A2)

Heat shrinkable tubing is available in various diameters for different splice sizes and configurations. When shrunk, it forms a small, flexible hermetic seal.

Other methods (tape, PVC mold) do not provide a hermetic seal and are not recommended. Splice balancing is critical with heat shrink insulation. If the splice is extremely unbalanced (more circuits on one side than the other), heat shrink insulation will not provide a proper seal. Evaluate the use of double terminals instead of splices where practical in these situations.

Recommended Splicing Method — Crimp (For 10 - 22 AWG Diameter Wire to Like Wire Diameter)

1. Disconnect the battery ground cable.
2. Strip wires to appropriate length.
3. Install heat shrink tubing.



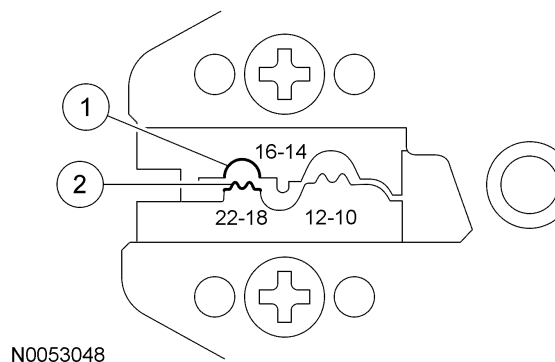
4. Select the appropriate wire splice for the wires to be spliced from Rotunda Wire Splice Kit 164-R5903.
5. **NOTE:**

Section 5: Electrical

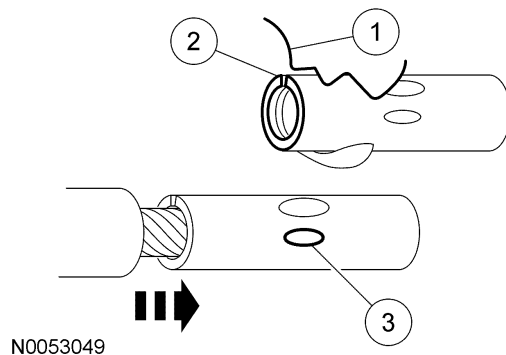
Rotunda Pro-Crimper 164-R5901 supplied with the wire splice kit is the only tool that can be used with these splices.

Identify the appropriate chamber on the Rotunda Pro-Crimper by matching the wire size on the dies with the wire size stamped on the butt splice.

- (1) Cavity
- (2) Indenter

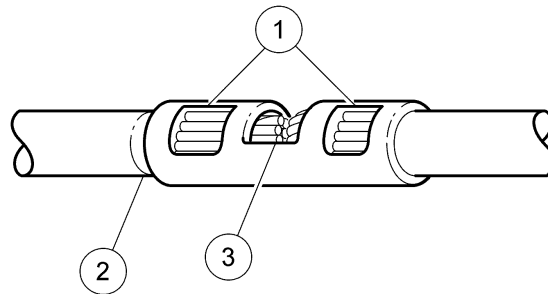


6. Crimp the connector.
 - (1) Center one end of the wire splice in the appropriate crimping chamber.
 - (2) Insert stripped wire into the barrel.
 - (3) Holding the wire in place, squeeze the tool handles until the ratchet releases.



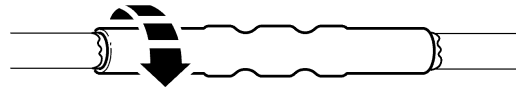
7. Repeating Step 6, crimp the other half of the splice.
8. Check for acceptable crimp.
 - (1) Crimp should be centered on each end of the butt splice.
 - (2) Wire insulation does not enter butt splice.
 - (3) Wire is visible through inspection hole of splices.

Section 5: Electrical



N0053050

9. Evenly position supplied heat shrink tubing over wire repair.
10. Use a shielded heat gun to heat the repaired area until adhesive flows out of both ends for the heat shrink tubing.



N0070450

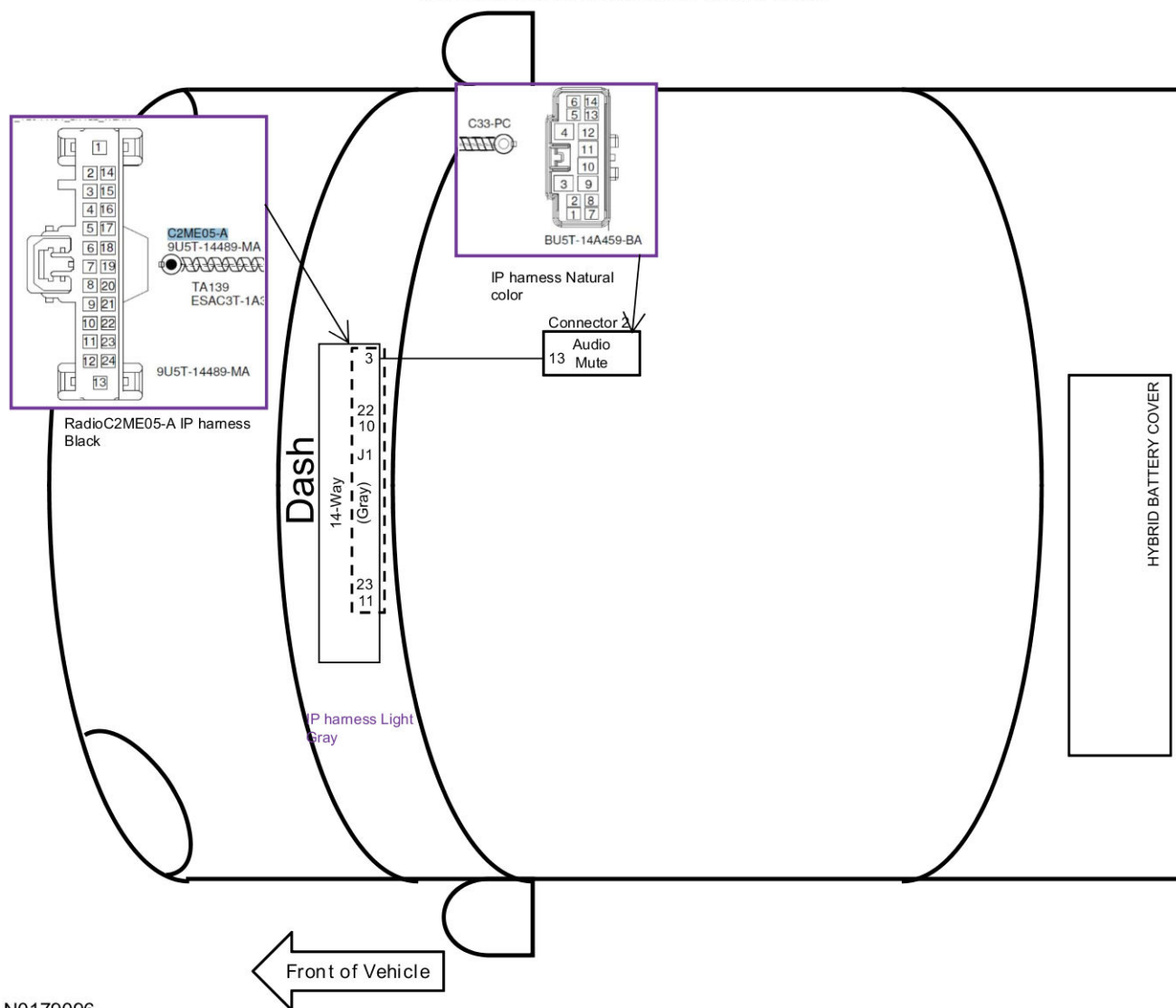
11. Reconnect the battery ground cable.

Hybrid Responder Sedan — Wiring Diagram Package Options

Section 5: Electrical

Vehicle/Law Enforcement Radio Mute

2019 Hybrid Police Responder Sedan Vehicle/Law Enforcement Radio Mute

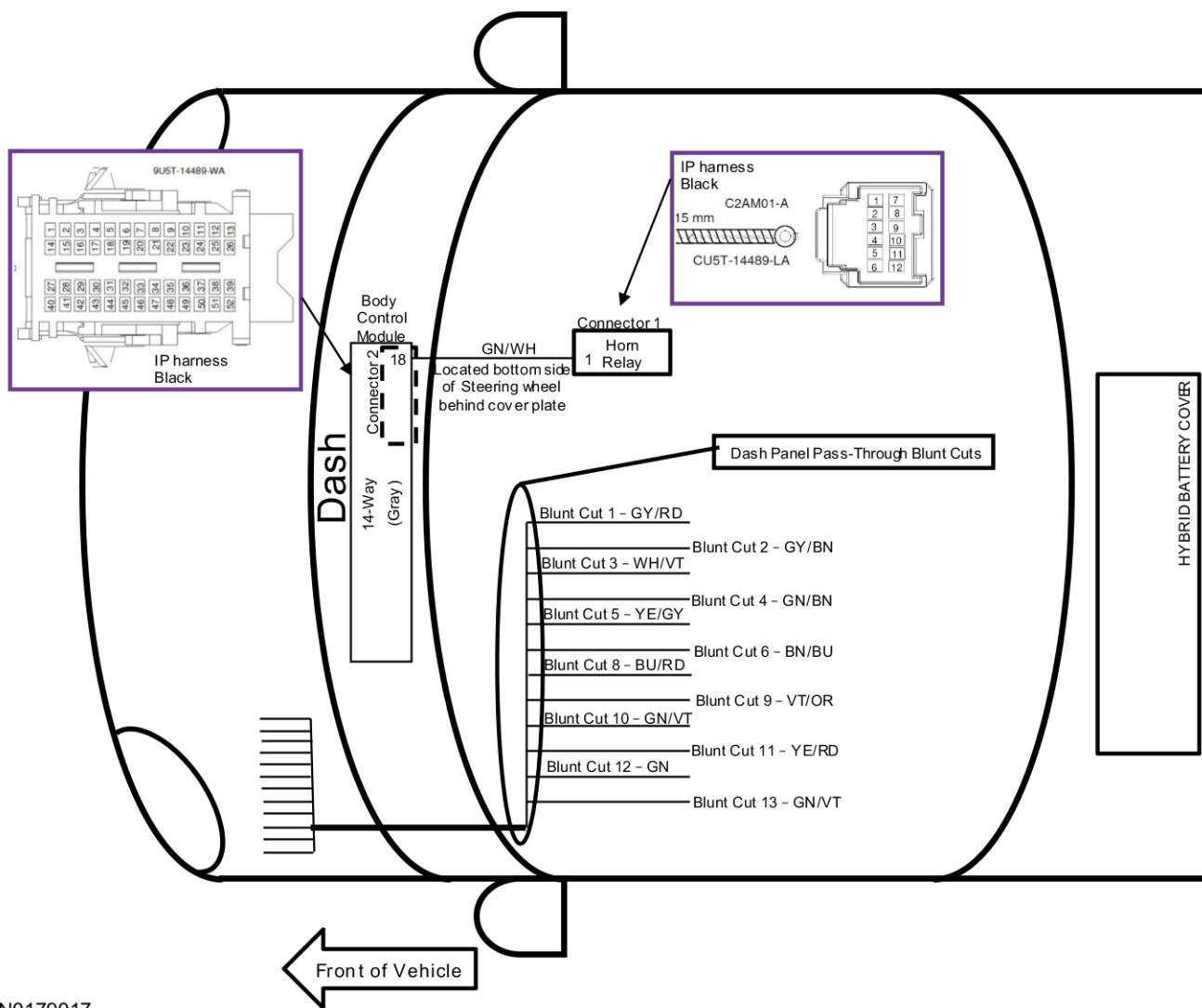


N0179096

Section 5: Electrical

Modifier Pass-Through Circuits

2019 Hybrid Police Responder Sedan Upfit Pass Through Circuits

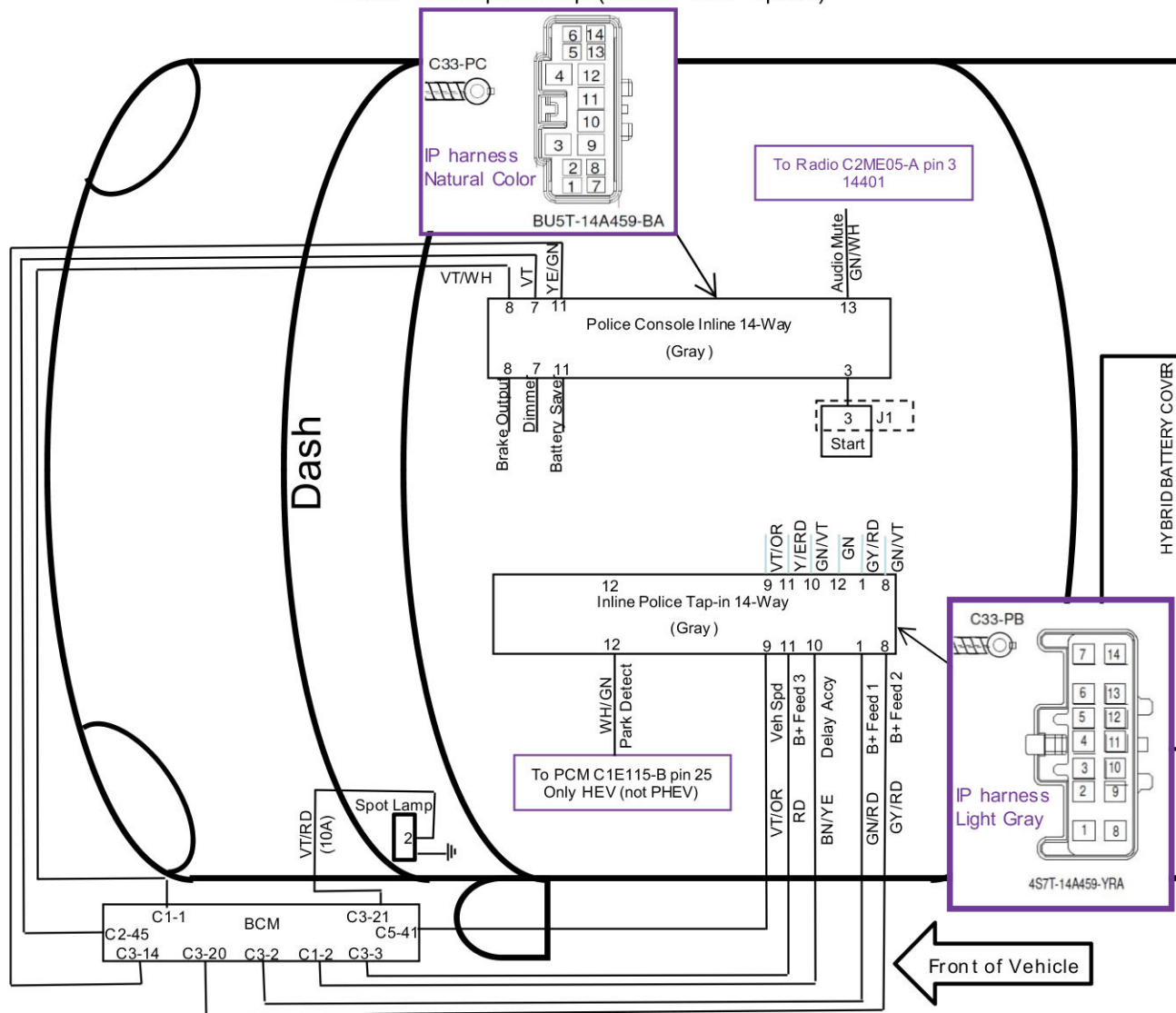


N0179017

Section 5: Electrical

Driver Side Spot Lamp (Stand Alone Option)

2019 Hybrid Police Responder Sedan
Driver Side Spot Lamp (Stand Alone Option)

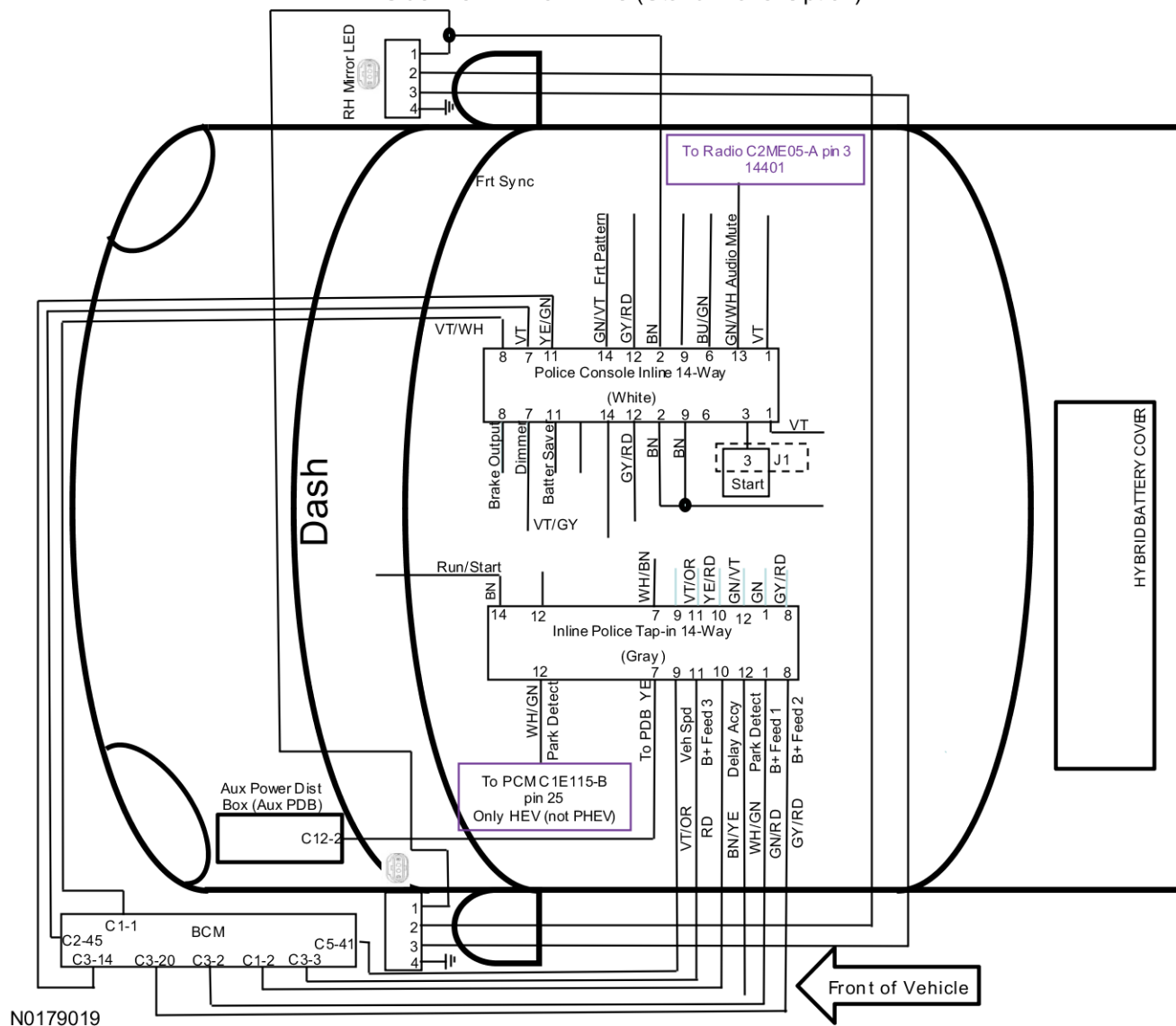


N0179018

Section 5: Electrical

Side View Mirror LEDs (Stand Alone Option)

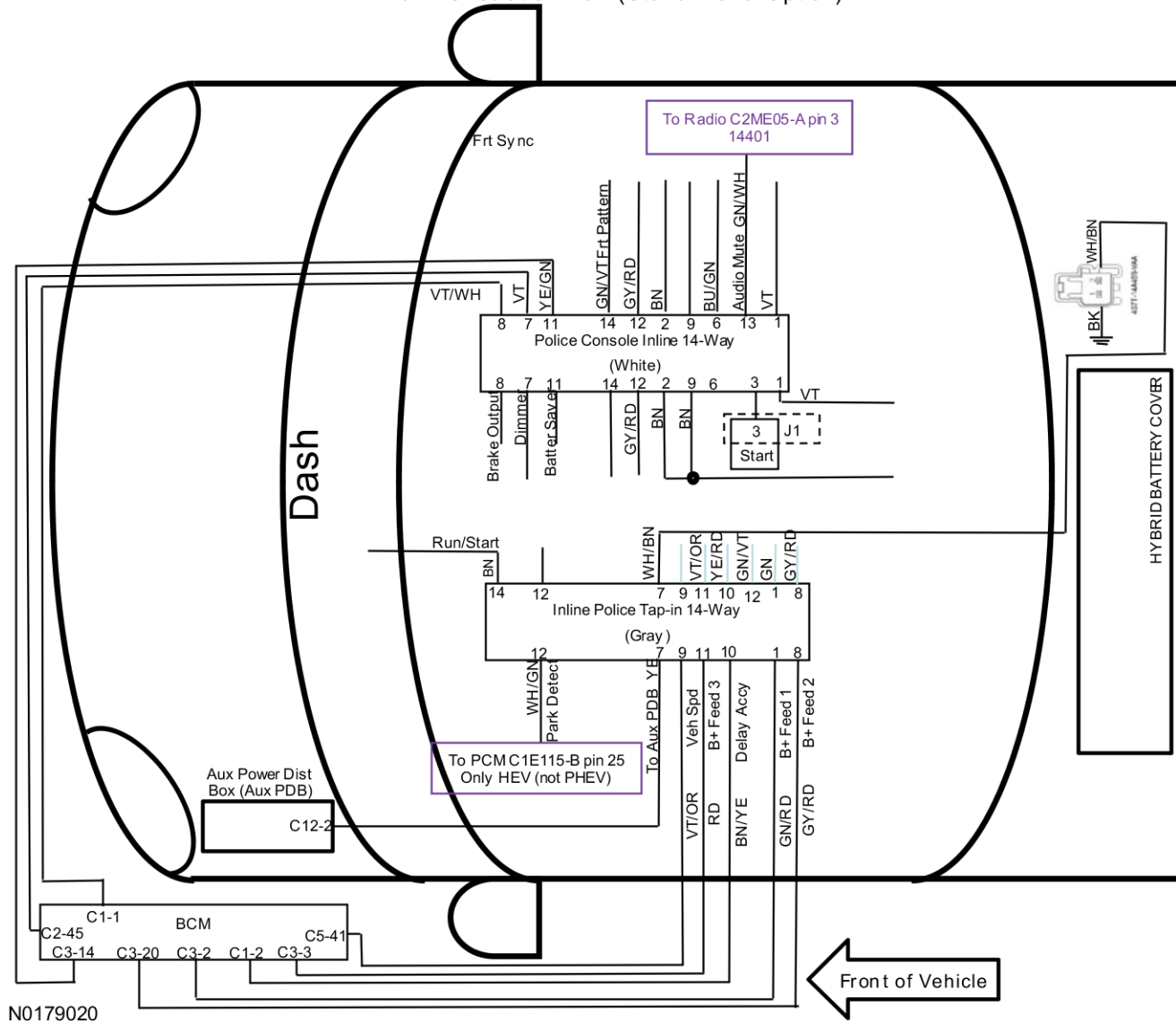
2019 Hybrid Police Responder Sedan
Side View Mirror LEDs (Stand Alone Option)



Section 5: Electrical

Trunk Circulation Fan (Stand Alone Option)

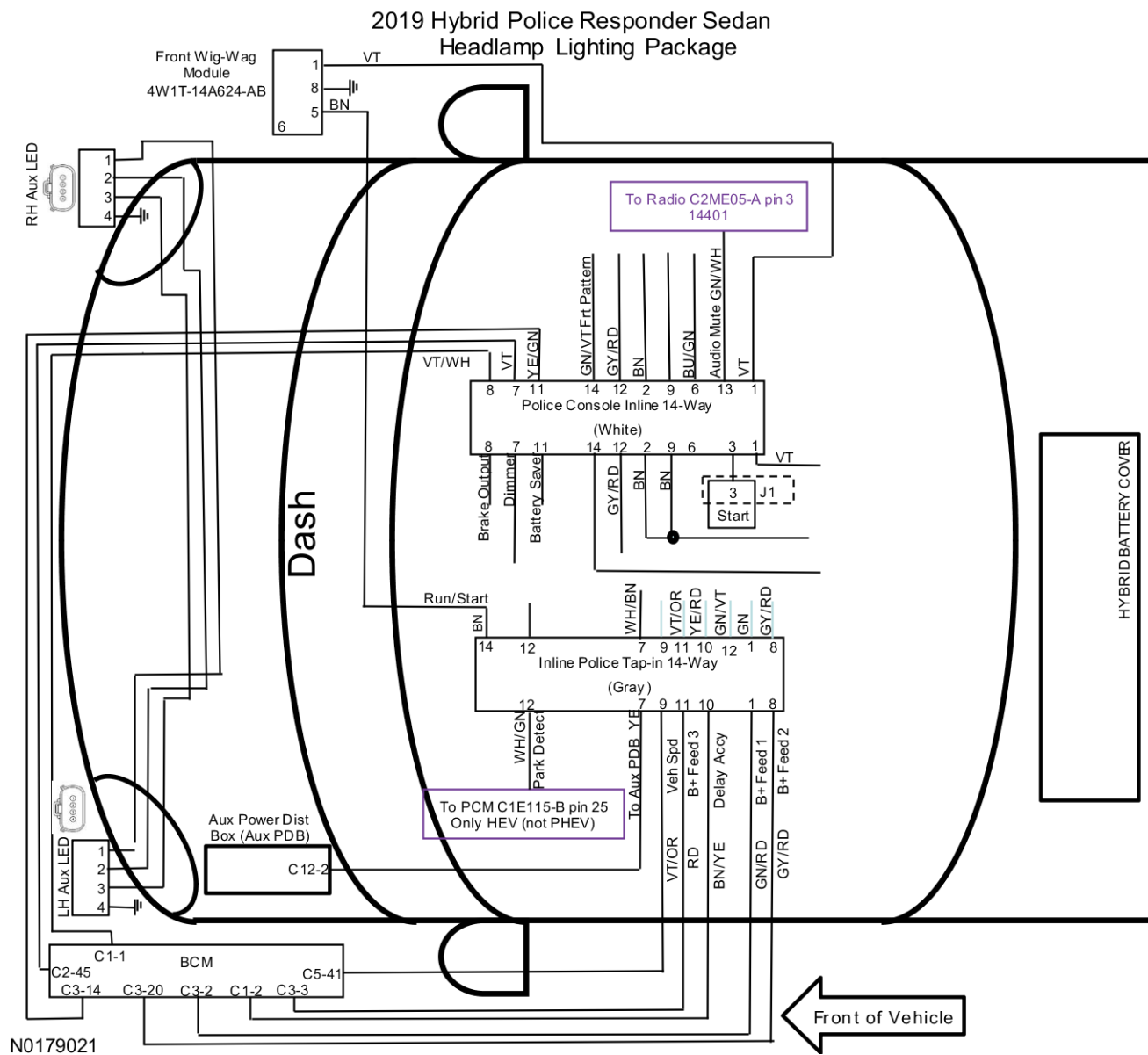
2019 Hybrid Police Responder Sedan
Trunk Circulation Fan (Stand Alone Option)



N0179020

Section 5: Electrical

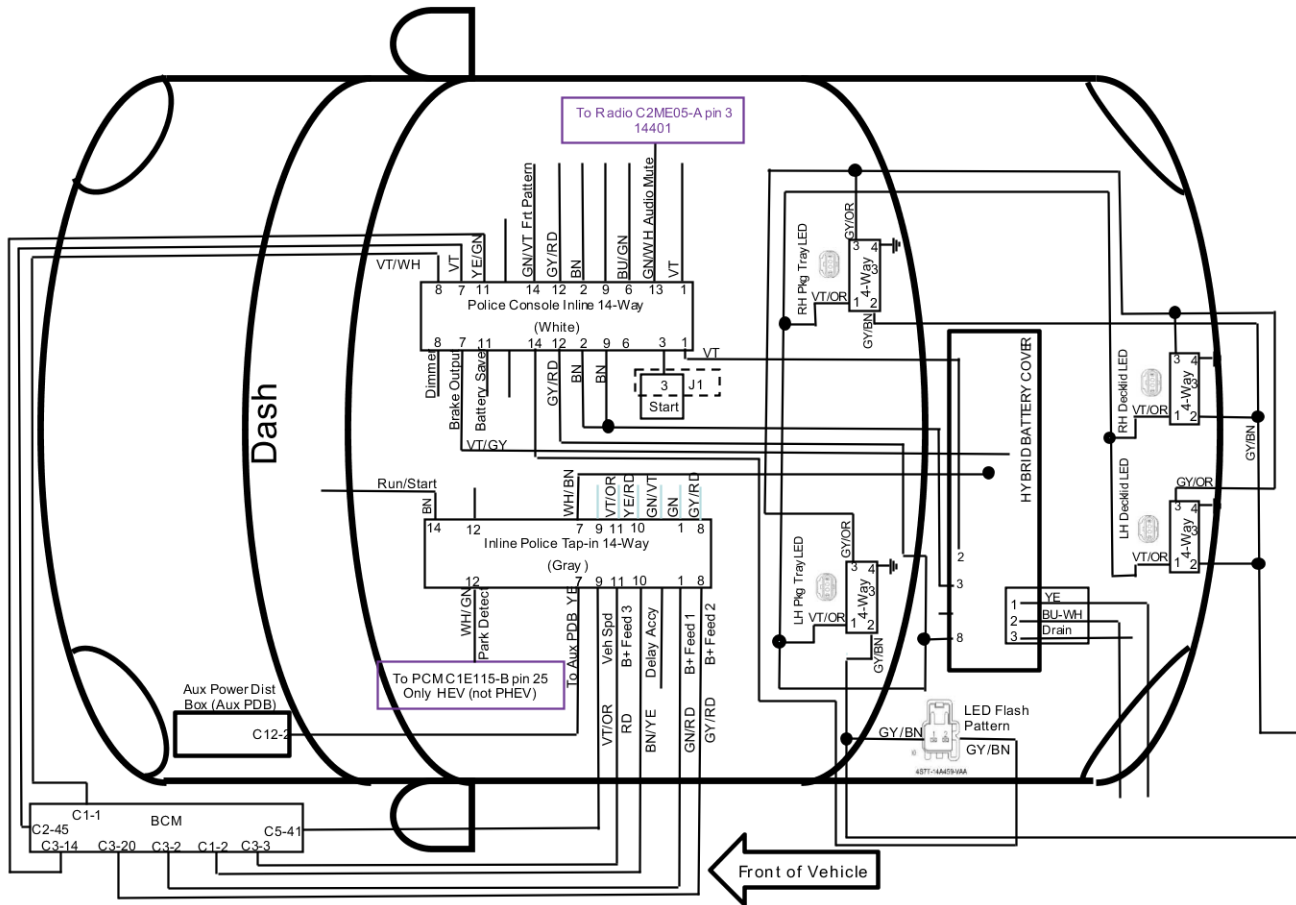
Headlamp Lighting Package



Section 5: Electrical

Rear Lighting Solution (Stand Alone Option)

2019 Hybrid Police Responder Sedan
Rear Lighting Solution (Stand Alone Option)

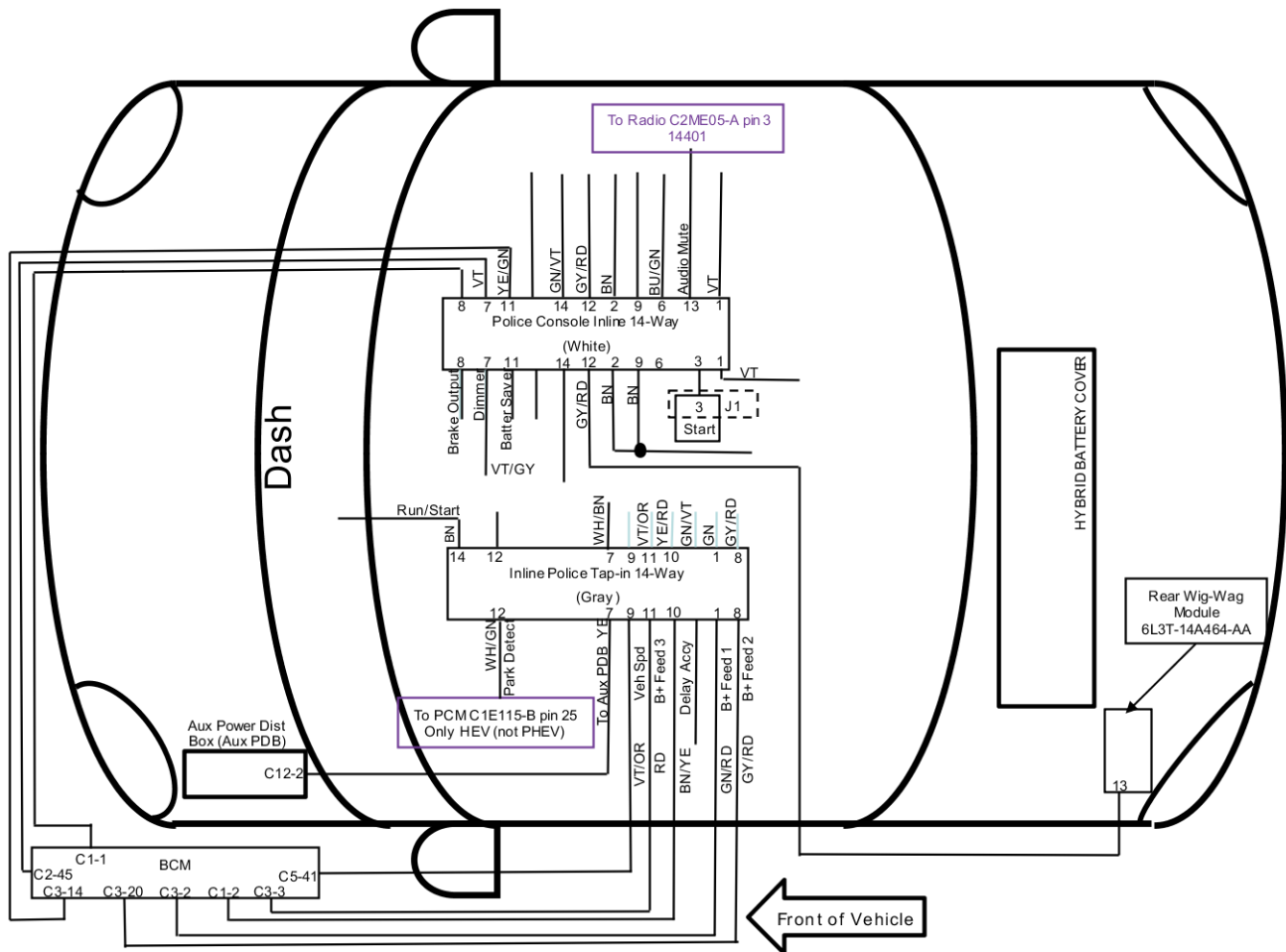


N0179022

Section 5: Electrical

Tail Lamp Lighting Module (Stand Alone Option)

2019 Hybrid Police Responder Sedan
Tail Lamp Lighting Module (Stand Alone Option)



N0179023

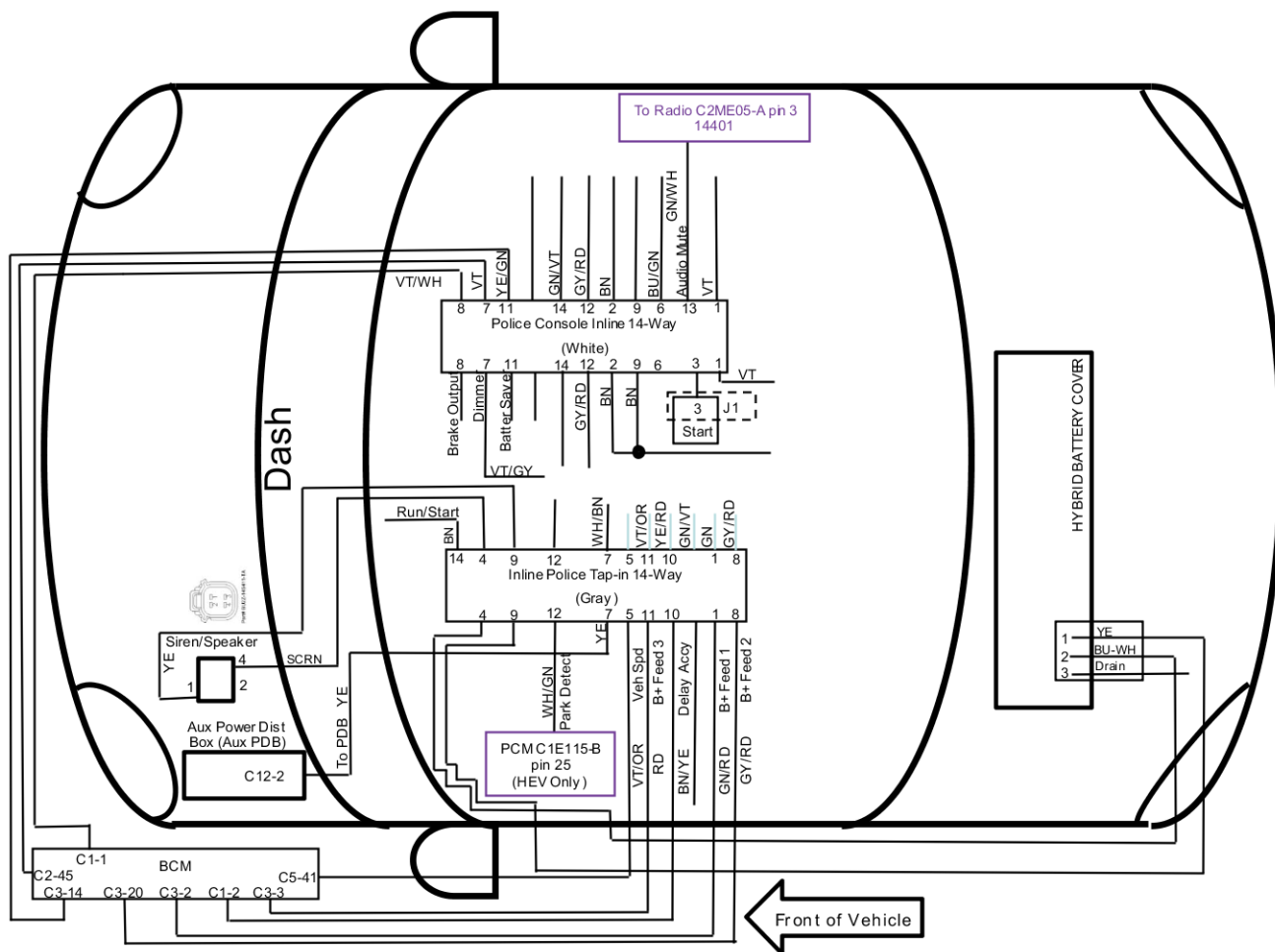
Ultimate Wiring Package

2019 Fusion Hybrid Responder Sedan Modifiers Guide, 8/2018

Section 5: Electrical

Siren/Speaker Wiring (Stand Alone Option)

2019 Hybrid Police Responder Sedan
Siren/Speaker Wiring (Stand Alone Option)

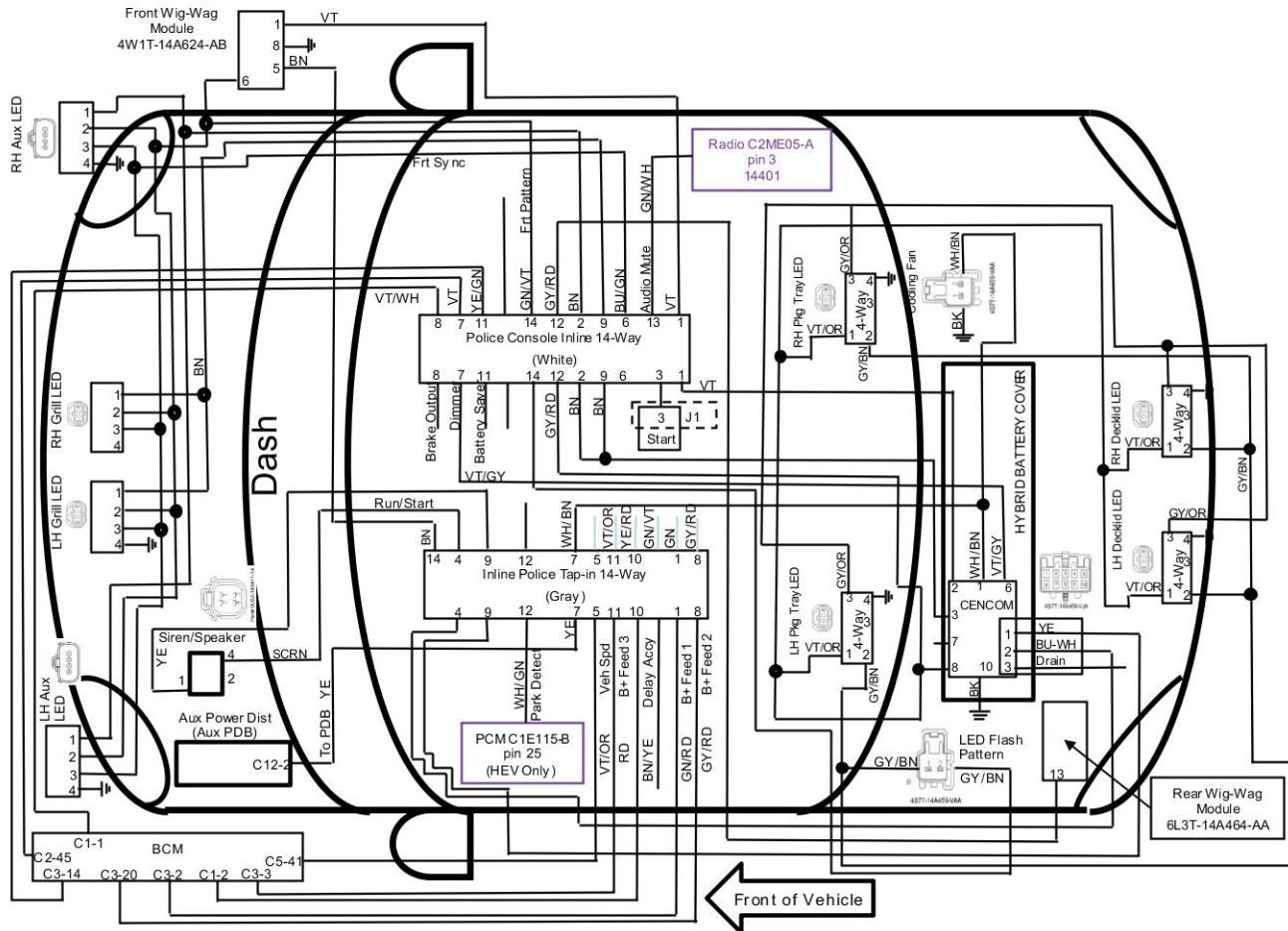


N0179025

Section 5: Electrical

Ready-For-The-Road Option

2019 Hybrid Police Responder Sedan Ready- for- the - Road Option



N0179026

SECTION 6: Mounting

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Section 6: Mounting

Section 6: Mounting

Push Bumpers

Ford Motor Company does not recommend the installation of any type of push bumper.

Siren and Grille Lights

NOTICE:

Do not modify the cooling system. High-voltage vehicle components may be damaged if any cooling system modifications are attempted.

The cooling system relies on proper airflow through the radiator to keep components at their proper operating temperature. When adding sirens and grille lights to a vehicle, make sure this airflow is not obstructed. Reduced airflow could put additional strain on the cooling system and shorten the operational life of related components. The cooling system also cools the electric motors and electronics. If the coolant exceeds certain temperatures, the components will attempt to protect themselves by limiting the power and torque available. During the installation process, keep the placement of components away from the grille area of the vehicle.

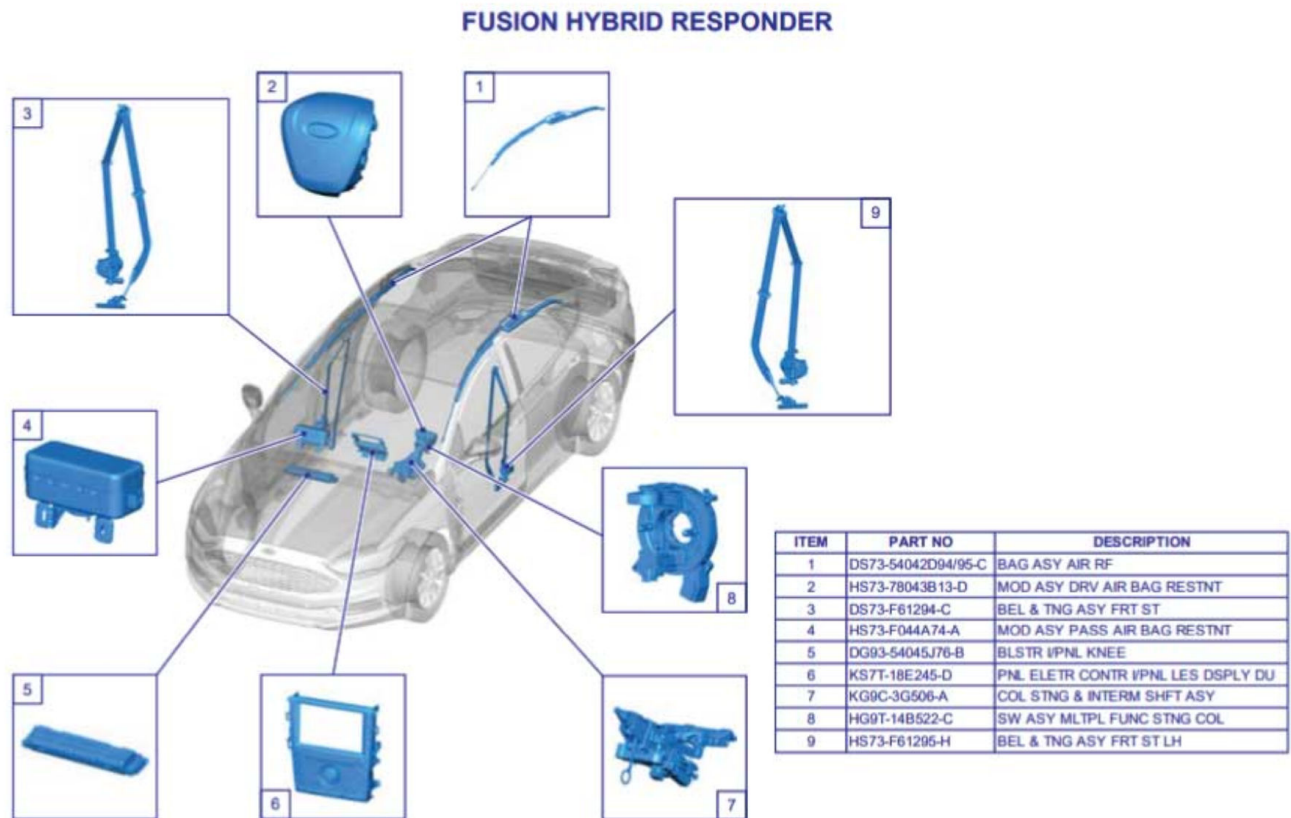
Mounting Equipment to the Vehicle

- Do not mount equipment to the high-voltage (orange) wiring/cables, the high-voltage cover or the HVTB cooling plenum.
- Do not mount equipment on the instrument panel between the driver and passenger air bags due to deployment variability.
- Do not mount equipment on the instrument panel between the driver and the pedals, between the door and the console area due to knee air bag deployment variability.
- Do not mount equipment obstructing the HVTB service disconnects located behind the rear seatback and underneath the vehicle near the RH rear tire.
- Do not remove or block the HVTB cooling plenum or ducts. These components are necessary for the proper cooling of the HVTB.
- Do not cover any warning or vehicle labels.
- **NOTICE:**
The side impact sensors are tuned to excite based on their mass (including wiring), as well as the host sheet metal. Any alteration to these components must be avoided. Additions, such as padding, wire connectors, retainers, tape or fasteners of any kind should not be used. All fasteners in this predominantly sheet metal environment should be made of steel or a non-conductive plastic to guarantee retention and longevity. If any part of a steel fastener is exposed to a wet area, it should be plated to resist corrosion.
- Do not mount equipment to the A, B or C-pillars.
- Do not mount equipment on the headliner within 200 mm (8 in) of the side edges.
- Do not mount equipment above the beltline within 200 mm (8 in) of the side glass from the A-pillar leading edge to the rear edge of the C-pillar.
- Do not mount equipment on the headliner along the siderails.
- Do not install a partition, divider or equipment that spans the vehicle above the beltline.

Safety Restraints

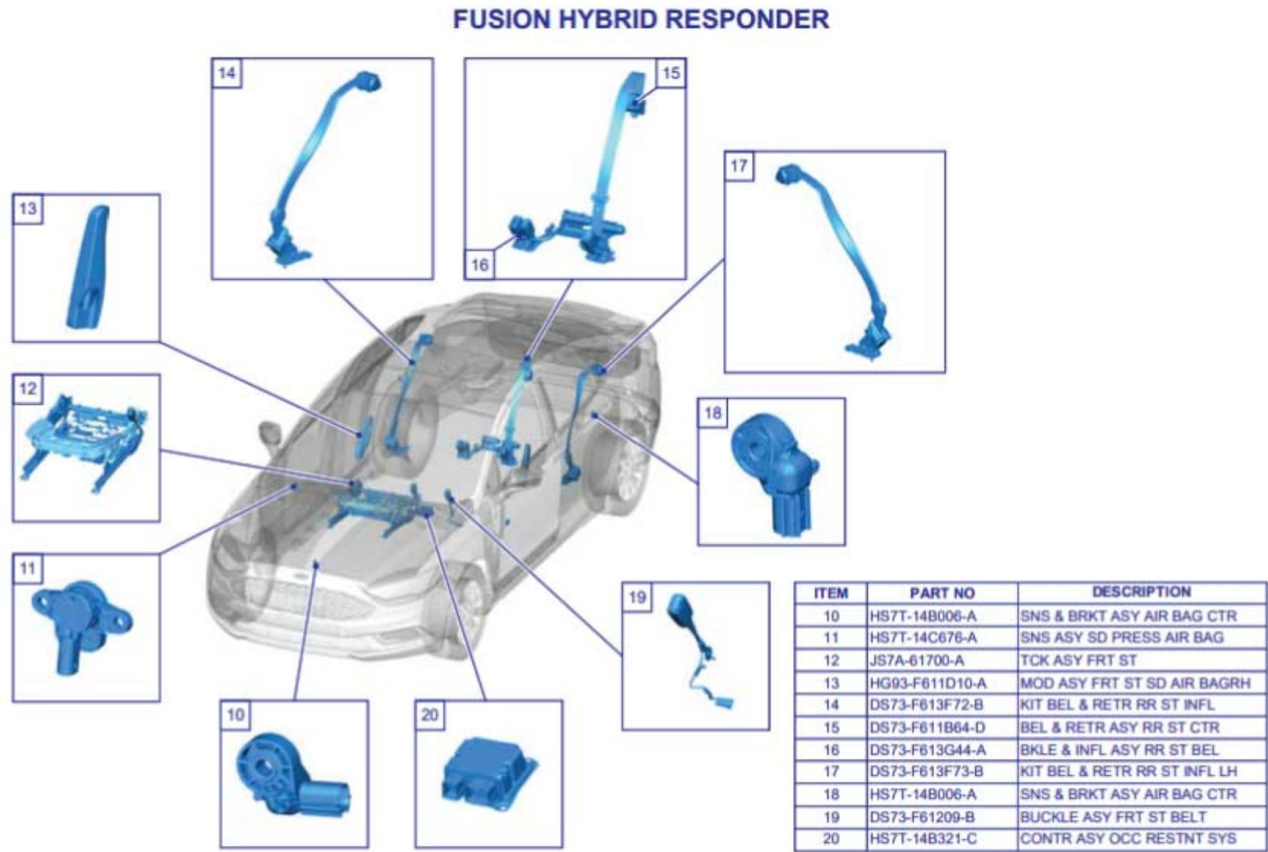
Various safety restraints exist within the vehicle, the restraint system includes various modules, sensors, retractors, airbags and the safety belt systems. Refer to the vehicle workshop manual for a more detail on the safety restraint system.

Section 6: Mounting



N0179043

Section 6: Mounting



N0179044

Safety Belt Retractor

The safety belt retractors are located in the base of the B-pillars. The pretensioner located in the retractor is referred to as the safety belt retractor pretensioner. In the event the RCM senses an impact, pretensioners provide improved occupant protection by rapidly removing slack from the safety belt. Removing slack from the safety belt helps to properly position the occupant and allows for maximum effectiveness of the safety belts and the air bags.

- Do not use the safety belt retractor bolts for mounting the partition.
- Do not mount any partition hardware on the inboard side of the B-pillar within the bottom 305 mm (12 in).
- Do not mount any partition hardware that will interfere with the proper sealing of the door.

Side Impact Sensor

The side impact sensors are located in the front doors and C-pillars; one sensor in each door and in each C-pillar. The location and orientation are critical for the correct operation of all the impact sensors. Do not use the attachment bolts of the impact sensors to mount any equipment.

Restraints Control Module (RCM)

The RCM is mounted under the front of the center console. The RCM orientation is critical for proper operation of the restraint systems. Do not relocate, or use the RCM mounting bolts for attachment purposes of any equipment.

Air Bag Deployment Interference



WARNING:

Section 6: Mounting

Do not place objects or mount equipment in front of the air bag module cover or in the front seat area; this is to avoid contact with a deploying air bag. Placing objects on or over the air bag inflation area may cause those objects to be propelled by the air bag. Failure to follow these instructions may result in personal injury.

**WARNING:**

Dash, tunnel or console-mounted equipment should be placed only within their specified zone. Failure to follow this instruction may result in personal injury.

**WARNING:**

Do not mount equipment between the side of the front seat and the door trim that would block deployment of the side air bag. Failure to follow this instruction may result in personal injury.

**WARNING:**

Do not mount equipment on the instrument panel between the driver and the pedal area, between the door and the console that may come in contact with or block a deploying knee air bag. Failure to follow this instruction may result in personal injury.

**WARNING:**

Do not attempt to service, repair or modify the air bag supplemental restraint systems (SRS) or its fuses. See your Ford or Lincoln dealer. Failure to follow this instruction may result in personal injury.

**WARNING:**

Modifications to the front end of the vehicle, including frame, bumper, front end body structure, tow hooks and B-pillar surrounding parts may affect the performance of the air bag sensors, increasing the risk of injury. Do not modify the front end of the vehicle.

**WARNING:**

Do not place objects or mount equipment on or near the headliner at the siderail that may come into contact with a deploying Safety Canopy® System. Failure to follow this instruction may increase the risk of personal injury in the event of a collision.

**WARNING:**

Do not attempt to service, repair or modify the Safety Canopy® System, its fuses, the A, B, or C-pillar trim, or the headliner on a vehicle containing a Safety Canopy® System. See your Ford or Lincoln dealer.

**WARNING:**

To reduce risk of injury, do not obstruct or place objects in the deployment path of the inflatable Safety Canopy® System.

NOTICE:

The side impact sensors are tuned to excite based on their mass (including wiring), as well as the host sheet metal. Any alteration to these components must be avoided. Additions, such as padding, wire connectors, retainers, tape or fasteners of any kind should not be used. All fasteners in this predominantly sheet metal environment should be made of steel or a non-conductive plastic to guarantee retention and longevity. If any part of a steel fastener is exposed to a wet area, it should be plated to resist corrosion.

Driver/passenger air bags affect the way equipment can be mounted in vehicles. Any surfaces that could come into contact with an air bag during deployment must not damage the air bag or alter its deployment path. Sharp edges, corners or protrusions could damage the nylon air bag material and reduce the effectiveness of the air bag. Do not mount or place any objects in the deployment path of an air bag. Air bags must be allowed to fully deploy without restriction. The deployment of air bags is not compatible with any configuration of equipment mounting that places objects in the air bag deployment path. Equipment mounted or placed in the deployment area of an air bag will reduce the effectiveness of the air bag, damage the air bag and potentially damage or dislodge the equipment.

Air bag deployment drawings are provided in Section 4. Consult the drawings before equipment is installed inside the passenger compartment to make sure that the mounted equipment does not interfere with air bag deployment.

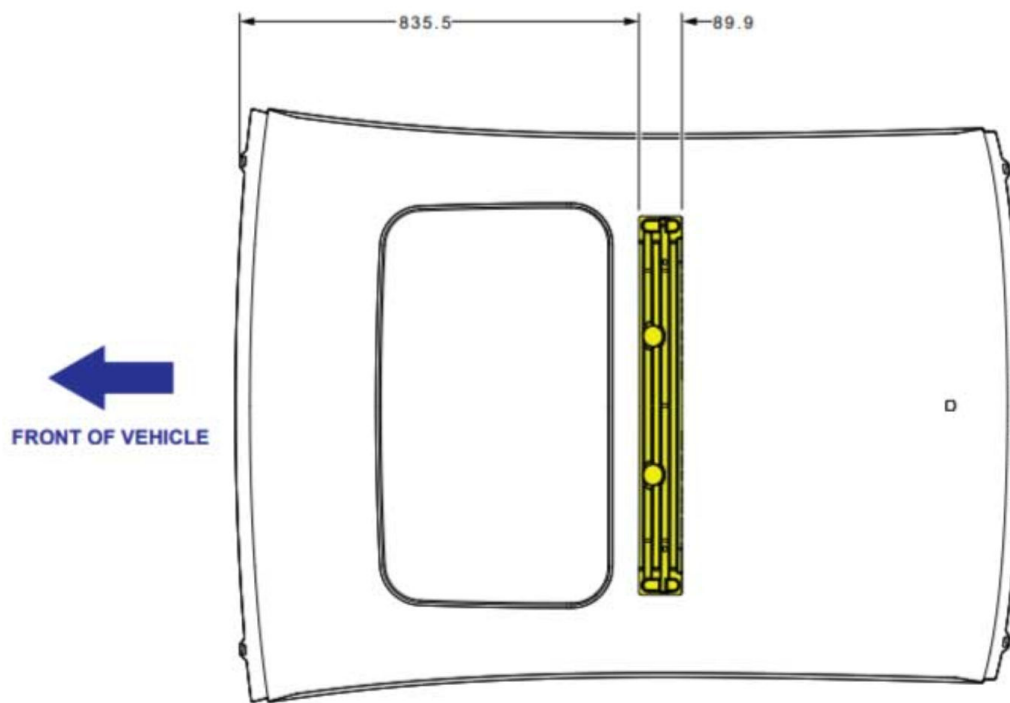
Section 6: Mounting

Seat Attaching Bolts

The vehicle safety belts and seat assemblies are factory installed in their correct location. Seat attaching bolts are not to be used as attachment points for any equipment. Any added material between the seat attaching bolt and the seat frame could have unpredictable effects on the seat bolt torque. If the safety belts are removed for any reason, all of the appropriate attaching hardware must be hand started and then tightened to the correct torque specifications as per the Workshop Manual. Proper operation must be verified before returning the vehicle to service.

Roof Bow For Light Bar Measurement

TOP VIEW ROOF OF FUSION HYBRID RESPONDER SHOWING FORWARD MOST ROOF BOW & MEASUREMENTS



N0179036

Trunk View

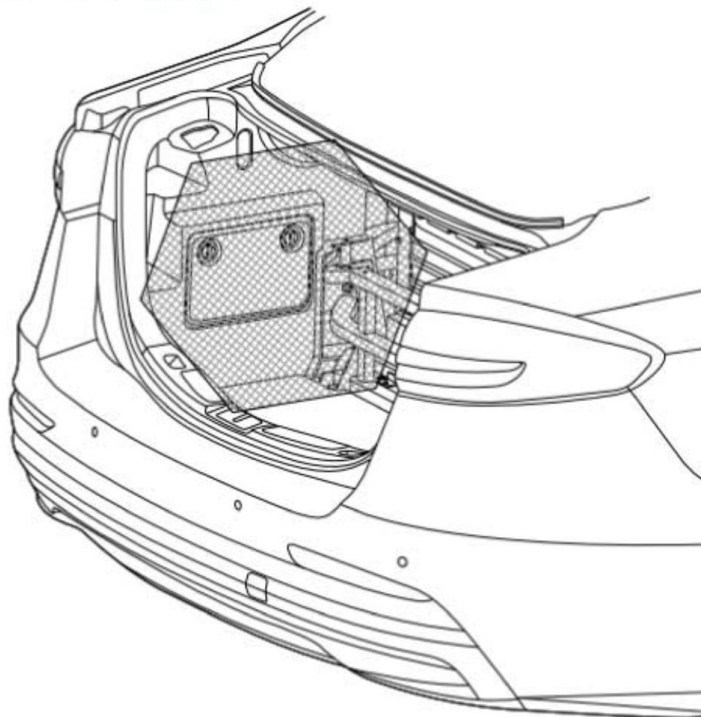
Drivers side of trunk shown no fasteners should be attached to passenger side of trunk in this area also.

Section 6: Mounting

TRUNK VIEW SILHOUETTE OF FUSION HYBRID RESPONDER



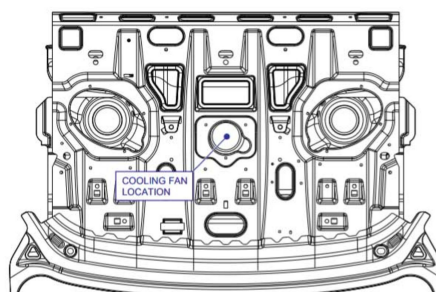
NO FASTNERS IN THIS AREA



N0179037

Package Tray Components

TOP VIEW SILHOUETTE OF FUSION HYBRID RESPONDER PACKAGE TRAY IN TRUNK NEAR REAR WINDOW



N0179038

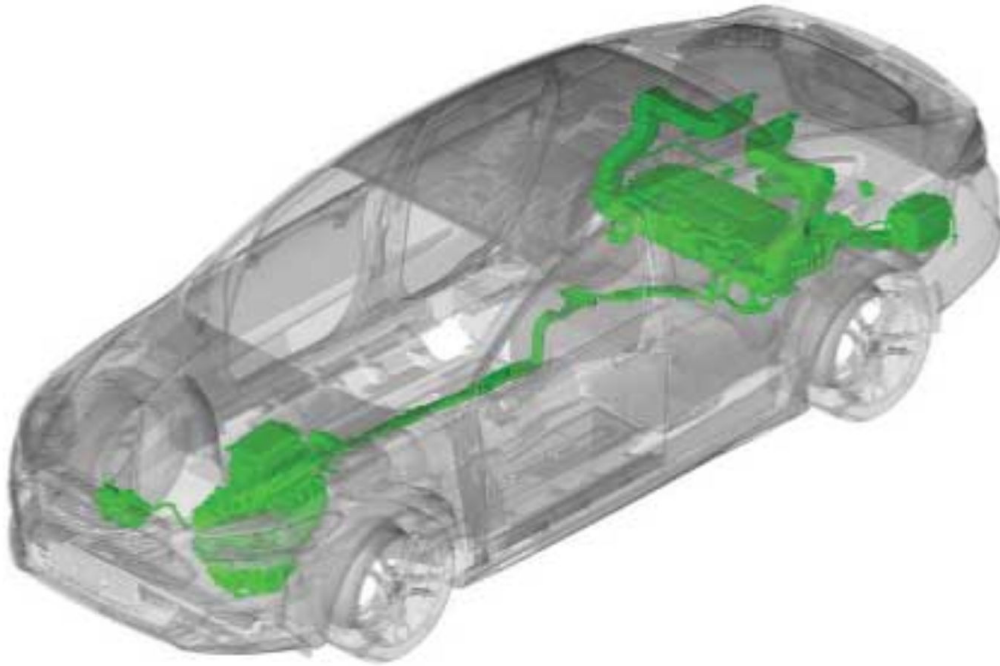
Areas to Avoid When Choosing Mounting Locations

The following illustrations show locations to avoid when choosing components mounting locations, these locations include: High Voltage Components and Cables, Fuel System Components, Brake System Components, and Exhaust Components. To avoid personal injury or damage to vehicle systems avoid drilling or mounting of components in these areas.

Section 6: Mounting

High Voltage System Components

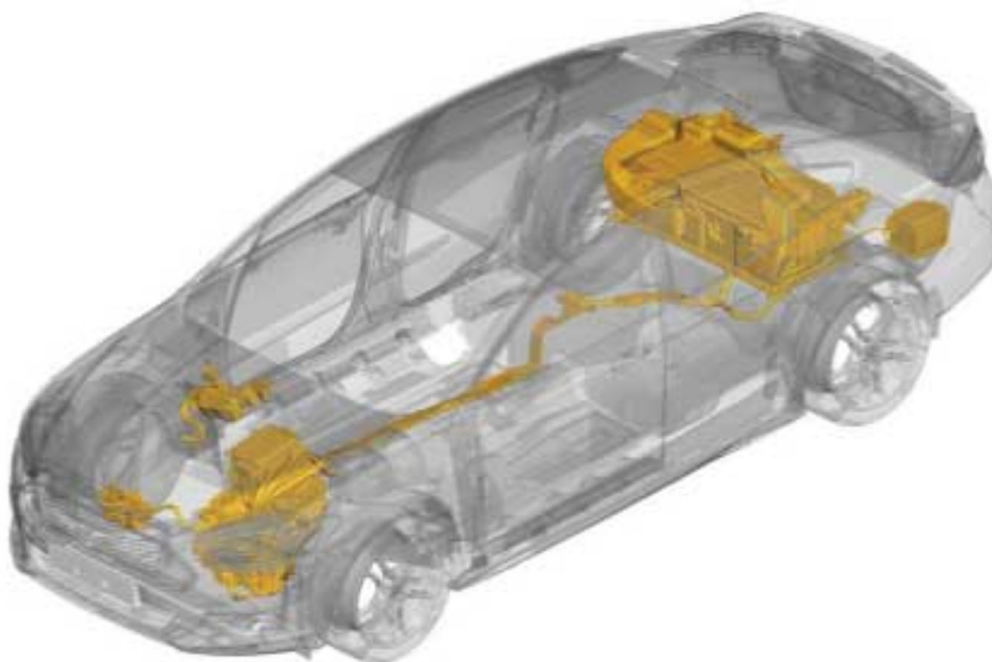
FUSION HYBRID HIGH VOLTAGE COMPONENT LOCATION



N0179137

Section 6: Mounting

FUSION ENERGI HIGH VOLTAGE COMPONENT LOCATION

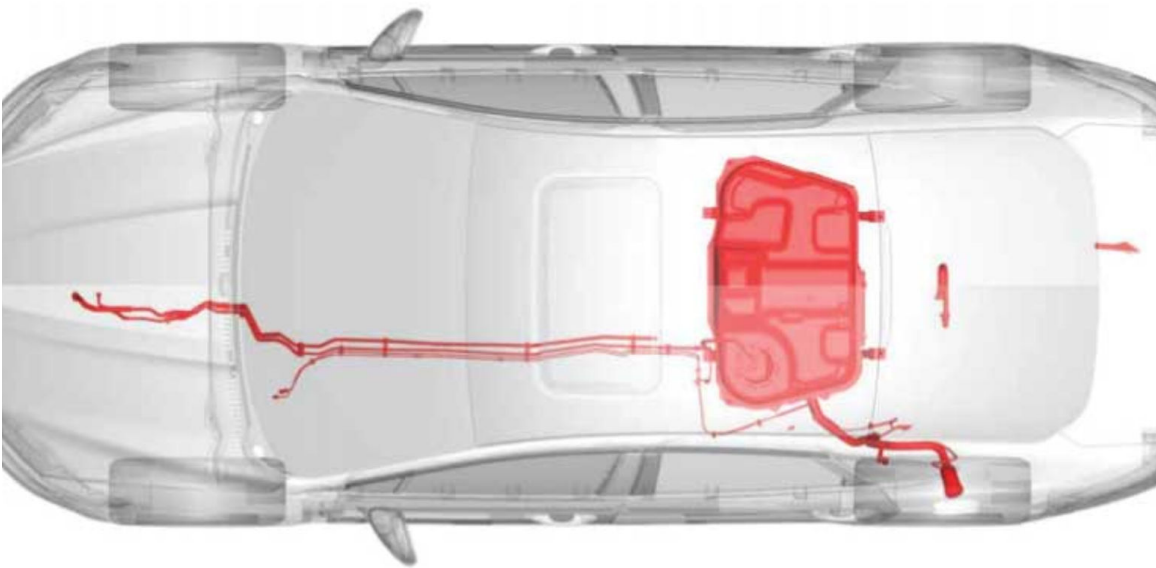


N0179136

Section 6: Mounting

Fuel System Components

**TOP VIEW SILHOUETTE OF FUSION HYBRID RESPONDER
WITH FUEL SYSTEM COMPONENTS**

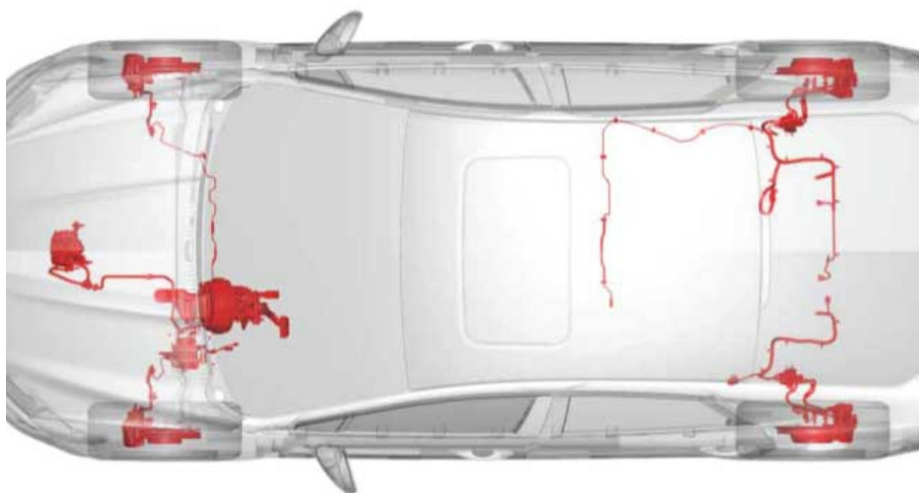


N0179040

Section 6: Mounting

Brake System Components

TOP VIEW SILHOUETTE OF FUSION HYBRID RESPONDER
WITH BRAKE SYSTEM COMPONENTS

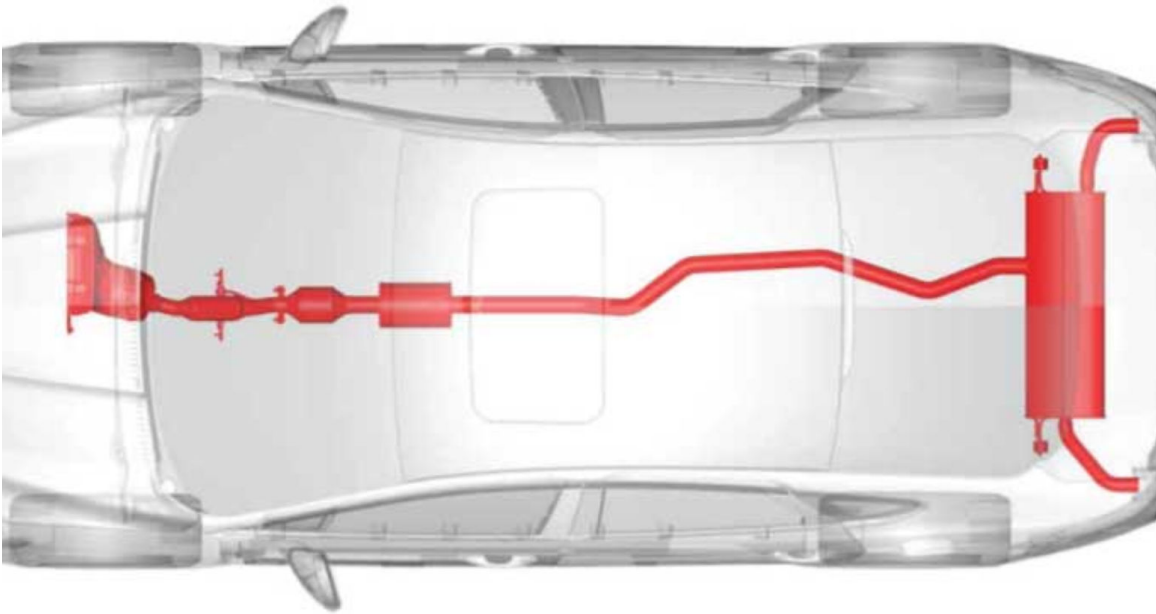


N0179041

Section 6: Mounting

Exhaust System Components

TOP VIEW SILHOUETTE OF FUSION HYBRID RESPONDER WITH EXHAUST SYSTEM COMPONENTS



N0179042

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Air Bag Deployment Interference Zones	7-2

Section 7: Air Bag Deployment Interference Zones

Section 7: Air Bag Deployment Interference Zones

Air Bag Deployment Interference Zones

**WARNING:**

Do not place objects or mount equipment in front of the air bag module cover or in the front seat area; this is to avoid contact with a deploying air bag. Placing objects on or over the air bag inflation area may cause those objects to be propelled by the air bag. Failure to follow these instructions may result in severe personal injury or death.

**WARNING:**

Dash, tunnel or console-mounted equipment should be placed only within their specified zone. Failure to follow this instruction may result in severe personal injury or death.

**WARNING:**

Do not mount equipment between the side of the front seat and the door trim that would block deployment of the side air bag. Failure to follow this instruction may result in personal injury.

**WARNING:**

Do not attempt to service, repair or modify the air bag supplemental restraint systems (SRS) in any way. Failure to follow this instruction may result in severe personal injury. See your Ford or Lincoln dealer.

**WARNING:**

Modifications to the front end of the vehicle, including frame, bumper, front end body structure, tow hooks and B-pillar surrounding parts may affect the performance of the air bag sensors, increasing the risk of injury. Do not modify the front end of the vehicle. Failure to follow these instructions may result in severe personal injury or death.

**WARNING:**

Do not place objects or mount equipment on or near the headliner at the siderail that may come into contact with a deploying safety canopy. Failure to follow this instruction may increase the risk of personal injury in the event of a collision.

**WARNING:**

Do not attempt to service, repair or modify the Safety Canopy® System, its fuses, the A, B or C-pillar trim, or the headliner on a vehicle containing a Safety Canopy® System. See your Ford or Lincoln dealer. Failure to follow these instructions may result in personal injury.

NOTICE:

The side impact sensors are tuned to excite based on their mass (including wiring), as well as the host sheet metal. Any alteration to these components must be avoided. Additions, such as padding, wire connectors, retainers, tape or fasteners of any kind should not be used. All fasteners in this predominantly sheet metal environment should be made of steel or a non-conductive plastic to guarantee retention and longevity. If any part of a steel fastener is exposed to a wet area, it should be plated to resist corrosion.

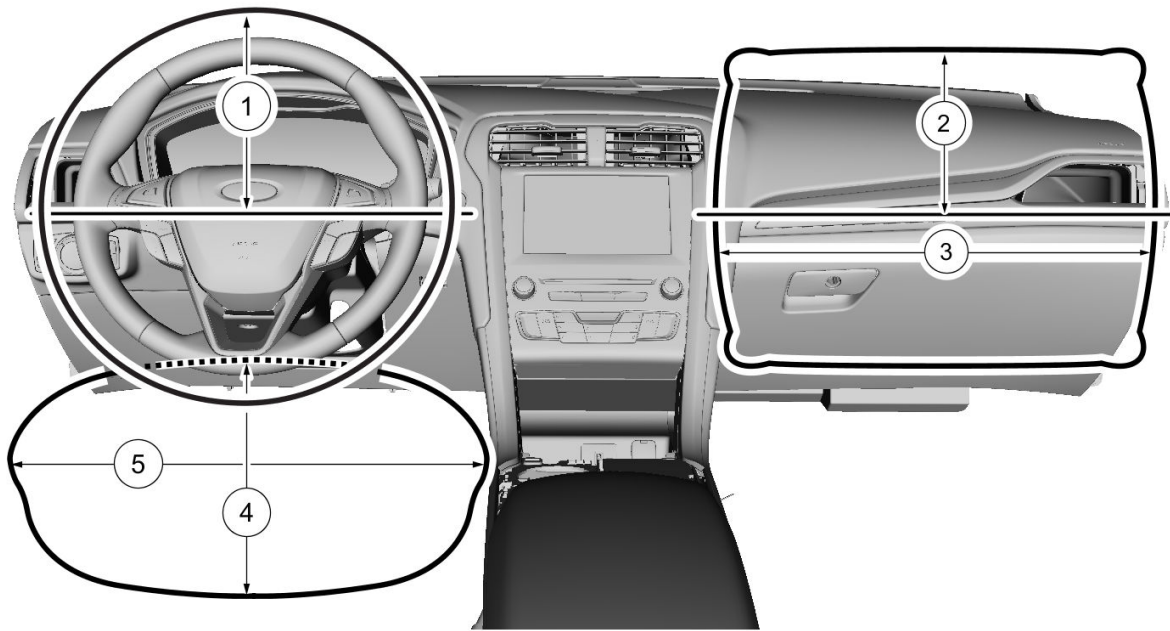
Driver/passenger air bags affect the way equipment can be mounted in vehicles. Any surface that could come into contact with an air bag during deployment must not damage the air bag or alter its deployment path. Sharp edges, corners or protrusions could damage the nylon air bag material and reduce the effectiveness of the air bag. Do not mount or place any objects in the deployment path of an air bag. Air bags must be allowed to fully deploy without restriction. The deployment of air bags is not compatible with any configuration of equipment mounting that places objects in the air bag deployment path. Equipment mounted or placed in the deployment area of an air bag will reduce the effectiveness of the air bag, damage the air bag and potentially damage or dislodge the equipment.

Some approximate dimensions for air bags, at full inflation, are provided. These dimensions are somewhat flexible and represent free-form deployments without the loading of occupants. The zone dimensions provided are approximate and will vary with the loading of occupants in the seats.

All air bag and equipment mounting zone dimensions are approximate due to different air bag deployment characteristics.

Do not mount equipment between the side of the front seat and the door trim that would block deployment of the side air bag.

Section 7: Air Bag Deployment Interference Zones



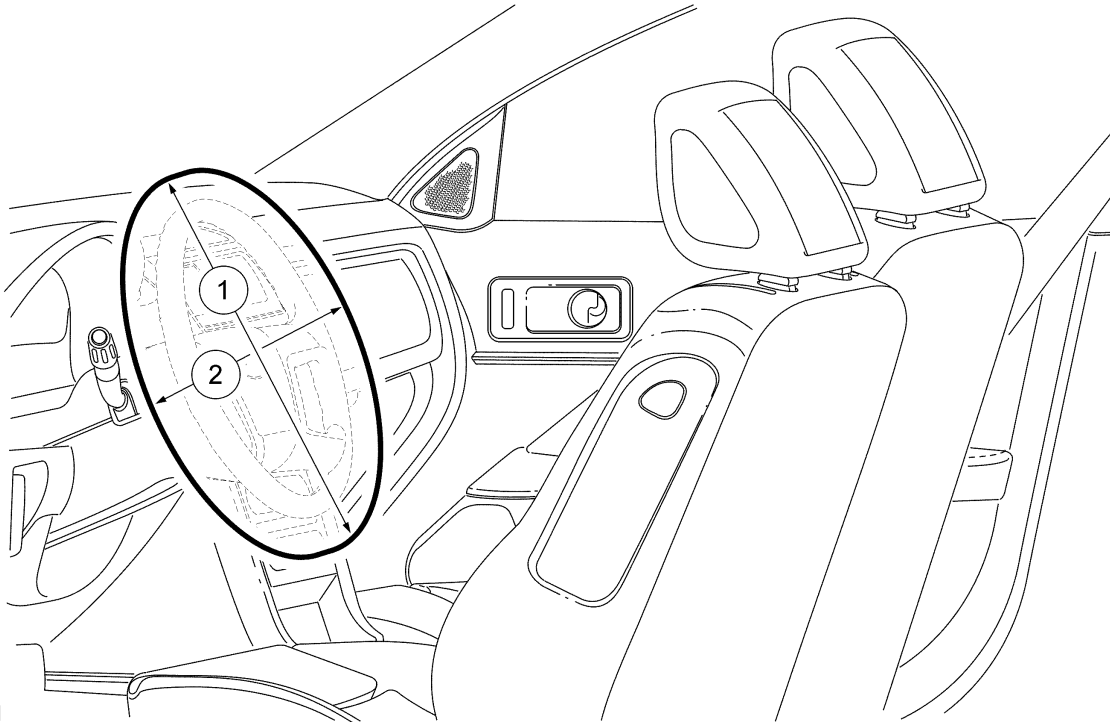
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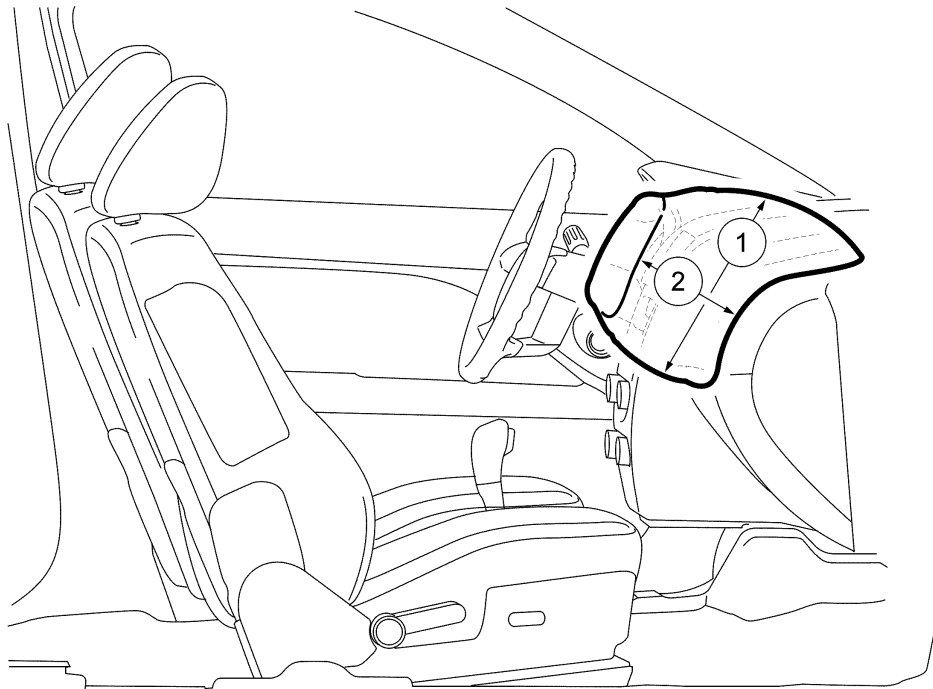
Do not mount equipment on the instrument panel between the driver and passenger air bags due to deployment variability.

1. 350 mm (13.779 in) from center of air bag door
2. 350 mm (13.779 in) from center of air bag door
3. 510 mm (20.078 in)
4. 150 mm (5.9 in)
5. 500 mm (19.7 in)

Section 7: Air Bag Deployment Interference Zones

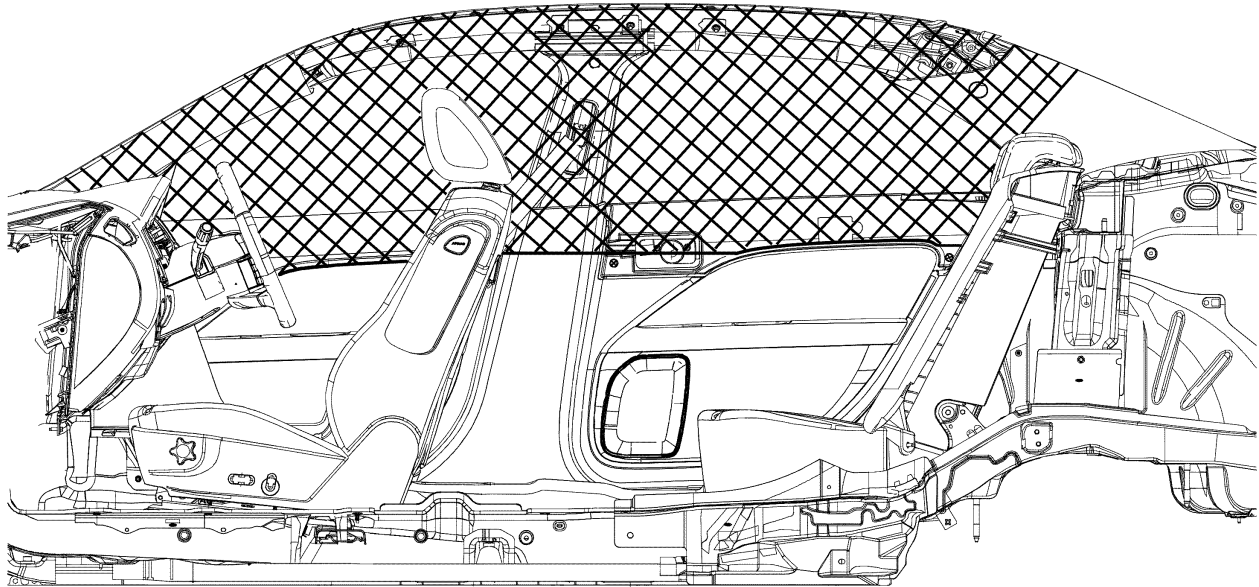


1. 660 mm (25.984 in) from center of air bag door
2. 660 mm (25.984 in) from center of air bag door



Section 7: Air Bag Deployment Interference Zones

1. 660 mm (25.984 in) from center of air bag door
2. 500 mm (19.685 in) from center of air bag door



N0103442

NOTICE:

Any surfaces that could come into contact with side air curtain (Safety Canopy® System) during deployment must not damage the curtain. Sharp edges, corners or protrusions could damage the curtain and reduce the overall effectiveness of the side air curtain.

NOTICE:

The side impact sensors are tuned to excite based on their mass (including wiring), as well as the host sheet metal. Any alteration to these components must be avoided. Additions, such as padding, wire connectors, retainers, tape or fasteners of any kind should not be used. All fasteners in this predominantly sheet metal environment should be made of steel or a non-conductive plastic to guarantee retention and longevity. If any part of a steel fastener is exposed to a wet area, it should be plated to resist corrosion.

- Do not mount equipment to the A, B and C-pillars.
- Do not mount equipment on the headliner within 200 mm (8 in) of the side edges.
- Do not mount equipment above the beltline within 200 mm (8 in) of the side glass from the A-pillar leading edge to the rear edge of the C-pillar.
- Do not mount equipment on the headliner along the siderails.